JANUARY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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FREDERICK J. WOLFE, D.D.S., New Orleans, La.
Vice President of the American Dental Association

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THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

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Original Communications

ESTHETICS IN FULL DENTURE CONSTRUCTION*

By I. L. FURNAS, D.D.S., Cleveland, Ohio

FULL denture construction is, without a doubt, one of the most important as well as the most interesting branches of dentistry. This statement is easily proved, if proof is necessary, by the fact that whenever two or more dentists get together for the purpose of discussing the various problems of the profession, some phase of full denture construction is almost certain to enter into the discussion. Almost without exception, on such occasions, the conversation is built around a problem of technic or materials, usually impressions, centric relation, occlusion, base materials, cast materials and other similar problems of interest and importance to all those rendering denture service. Without minimizing in any way the importance of such problems, I wish to call attention to another problem and one which, although it is by no means unfamiliar to you, has been too long treated almost with contempt by a vast majority of the men in the dental profession. I refer to esthetics.

A simple and yet practical definition of esthetics, as it is used in the sense in which we are interested, might be: Esthetics is the idealizing or harmonizing of the artificial with the natural. That seems perfectly simple and clear, and leaves little more to be said; but let us go a little farther. Esthetics is art, and who will dare be satisfied with himself as an artist? And now I find myself wandering into those beaten paths of theory, paths so often trod before by papers on this very subject. A tourist seldom of his own accord chooses a detour in preference to an improved highway. Detours are usually rough and often unpleasant, but frequently one sees sights not encountered on a much traveled highway that are well worth the difficulty involved. With this thought, we will leave "Hogarth's line of beauty," and all the other time-honored theoretical questions of art, and take a somewhat less traveled road for such presentations

*Read before the Section on Full Dentures at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 20, 1935.

in the hope of arriving at a very desirable point of practical application. The bumps that we shall encounter will be in the form of statements that you will hesitate to believe. I hope there are many because the greater the number of healthy arguments provoked by a paper, the better that paper, as a rule.

First, let me make the statement that esthetics in full denture construction, as employed by at least 90 per cent of men in general practice, can only be said to be conspicuous by its absence. How many full upper and lower cases have you seen during the past year that could not be detected as artificial during a five-minute visit at conversational distance? Yet we say that "the height of art is to conceal art." Many of the artificial dentures that we see announce their presence even before the lips are opened. Adaptation, occlusion and articulation may even approach perfection, but esthetic values are absent, or nearly so.

Wherein lies the cause? Is it the college? Perhaps the institution is partially to blame, but not entirely. The curriculum of every college is now so crowded that no department can hope to teach more than the basic fundamentals of the course. Esthetics receives its proportionate amount of time, in most of the schools at least.

One condition that might perhaps carry a part of the blame has been the great variety of methods and technics that have been developed during the past twenty years. Dentists have been so busy learning new systems, trying to fathom the intricacies of new articulators and the like, that they have become technicians in place of artists.

Another cause, and I believe perhaps the chief one, is the profession itself; but, in order to identify it, we must make an approach through the commercial dental laboratory. The custom that has become so prevalent in the profession of delegating all possible details to the dental laboratory has, in my opinion, been a mighty factor in our present status. It is not the fault of the laboratory entirely. We have expected the impossible of them. Many laboratories accomplish results little short of miraculous when given accurate impressions, measurements and bites and reasonable cooperation; but, when all that the laboratory receives is a set of impressions, perhaps of questionable origin, a mush bite and a scrap of paper with the instructions, "Shade 8," written on it, it is still a mystery how they accomplish as much as they do.

I fully realize that it is impossible for all men to do all of their own laboratory work, but I am positive that in direct ratio as the operator divorces himself from this work, that work must suffer. The last statement perhaps needs some qualification. I know of some cases in which the operator has relied completely, and for so long a time, on the dental laboratory that he can now no longer skilfully perform some of the more intricate technical steps. This is indeed another sad situation that should hardly be discussed here. I can only advise him that, for the sake of his patients, he either retrain himself or continue to work *for* the laboratory man.

There are three ways in which this mechanical work may be handled. The ideal way is for every man to do all of his own technical work. This enables him constantly to visualize his patient and harmonize his construction with an individual ideal. It enables him to inject into his work his own personality, so to speak. Something built by him for a certain person into which he has incorporated the peculiarities of that person. Such an artist would no more think of entrusting his work to other hands than would a Michaelangelo or a Raphael prepare a

canvas and outline his picture with charcoal and then send it to someone else to finish.

Such an idealistic plan is absolutely impossible in a great many offices; therefore, let us consider the next best, or second way in which this work may be handled.

Here, we have the operator or dentist taking care of every procedure wherein the patient is at all involved, and then entrusting to his personally trained technician in his own office laboratory such details of technic as may seem necessary. In this manner, the dentist is in constant contact with the work as construction develops, and, through the medium of his technical assistant, he meets the necessary artistic requirements. The success of such a plan depends entirely on the training of the technical assistant, the cooperation that the assistant receives from the dentist and the amount of work that the dentist is willing to do himself.

The third, and by far the least successful plan, is that in which the dentist for various reasons cannot follow either of the other two, and is forced to rely on the commercial dental laboratory. Here, under the best possible conditions, only a limited measure of success can be expected, and what success there is depends almost entirely on the cooperation the dentist is willing to give.

Please bear in mind the fact that we are not discussing technics, mechanics or construction, but the subject of art and esthetics. I have reference only to the blending and harmonizing of the construction to the individual conditions. No laboratory technician, regardless of his mechanical skill and ability, can possibly construct an artistic denture for a patient whom he has never seen. When you add to this handicap lack of cooperation on the part of the dentist, the result can only be failure.

When I refer to lack of cooperation on the part of the dentist, I do not wish to leave the impression that I believe this to be wilful or intentional. The dentist is, of course, anxious to receive the dentures in the best possible condition; but one of the greatest mysteries of the age, to me, is how a dentist who is ostensibly trained along all the lines of denture construction, and who is supposed to know and understand not only the functional requirements, but the esthetic demands as well, can submit impressions, bites and instructions to a dental laboratory when he should know absolutely that there is not the slightest possibility of success.

You say that I am exaggerating? Then, all I ask you to do is to spend one day in any large commercial dental laboratory and see what comes in. There will no longer be any doubt in your mind as to why dental laboratory men as a group have little respect for the mechanical ability or judgment of the average dentist.

A little box containing a set of plaster casts with "Shade 14" written in pencil on them, accompanied by a mush bite, is received almost daily in every dental laboratory of any size. The best possible results that can be expected from the most skilled technician under such circumstances are not "artificial dentures," but "false teeth that broadcast."

How can the best results be obtained with this plan? This is an extremely difficult question because of the great variance in ability of the different operators and the variety of conditions under which different men must work. Generally speaking, it seems that a plan varying more or less according to necessity might be followed. True, it will take more time, but the results should justify the effort.

First, select with care the laboratory which you expect to patronize. If pos-

sible, know personally the technician who is going to do your work. Consult with him and explain just what you want in your cases at every opportunity. Make of him your "personal technician." Take your impressions and, if convenient, let him pour the casts, reinforcing and building the bite-blocks or occlusal rims. This may not be practicable if the laboratory is located in another city.

When the bite-blocks are ready, establish the correct vertical dimension and the plane of occlusion. Attach the upper bite-block to the facebow. Make the transfer and mount the upper cast on the articulator. Establish centric relation with the gothic arch tracing and mount the lower cast on the articulator. Select the teeth, setting up the six upper anterior teeth, and at least the lower central incisors. I shall describe this particular step in more detail a little later.

Now, return to the technician for occluding and articulating the posterior teeth. The case is returned to the operator for final trying-in and checking of the occlusion, right and left lateral balance and esthetics. Again return to the technician for the finish. This outline of procedure will, of course, be varied to suit the different technics and methods employed by different operators. The idea, or division of labor, should remain essentially the same.

It is difficult to understand how much can be expected in the way of esthetics if the operator insists on divorcing himself from the actual work of construction to a greater degree.

Now let us consider esthetics from the point of view of the patient. Although it may seem quite wrong to us, there is not the least doubt that the average patient values esthetics above function. We have all witnessed the sad spectacle of a patient sitting in the operating chair and crying unashamedly when he realizes that he is face to face with the loss of all his natural teeth. What is in the mind of such a patient? Is he worried because of the fear that he cannot properly or efficiently masticate food? Never! That is about the last thing to enter his mind. It is the fear of that ghastly aged appearance that is the inseparable companion of most of the dentures we see today.

Every dentist who has had any considerable full denture practice has seen the following types of patients: Mrs. A. wears a full upper and lower set of artificial dentures. The adaptation is poor, but, with the aid of adhesive powders, she is able to keep them in place very satisfactorily. Although the occlusion and articulation are quite imperfect, by exercising much patience she is able to eat a few of the things she likes. By reason of this inefficiency, the tissues under the dentures are often sore and painful. To counter these deficiencies, the teeth are naturally arranged and normal and pleasing in appearance so that her most intimate friends are not aware of the fact that she wears artificial teeth. Will she part with these teeth, or will she have them remade and corrected? *She will not.*

Mrs. B., who also wears full upper and lower dentures, has only recently received them from her dentist. They are beautifully constructed. The adaptation and articulation approach perfection. Mastication seems to offer little or no difficulties, but since receiving her dentures, she has experienced several rather embarrassing situations. Not only her family, but also the whole neighborhood has been trying to convince her that she looks twenty years older. Some intimate and well-wishing friends have even tried to convince her that she no longer looks human. Another friend passed her on the street and did not speak, claiming

that since the great change, she did not know her. Will Mrs. B. keep those teeth? *She will not.*

These are not overdrawn cases. Such experiences, in a greater or lesser degree, occur in every denture practice. Oftentimes, these patients become more or less accustomed to their terrible appearance and will consent to keep and wear such dentures; but there is always present a certain mental anguish that does not gracefully accompany successful dentures.

There is no one feature of denture work, and, for that matter, no other single service, rendered a patient in the dental office that is more appreciated by the patient than the esthetic. Next to the elimination of pain, it is the greatest practice builder any man can possibly have. In view of this fact, it seems incredible that an important factor like esthetics could receive such an insignificant amount of attention from at least 90 per cent of the dentists.

If we are going to develop the individual esthetic values of our cases to the fullest extent, we must pay more attention to preextraction records than we have in the past. They are of the utmost importance in every case. These records can be made at any time prior to the extraction of the teeth. It is excellent practice for a dentist to make a complete set of such records for every patient over 40 years of age. Such a procedure will at least impress his patients with his thoroughness, and their comments among their friends can do him no harm.

These records can and should be checked and corrected from time to time, because the constant bone and tissue changes taking place in harmony with the advancing years render all such records more or less inaccurate, over a long period of time.

Suppose a patient comes to your office for some minor restorative operation: You note, in making your examination, that sooner or later this patient must lose all his natural teeth. At that time, you make preextraction records, explaining fully to the patient just what you are doing, and just why you are doing it. The patient is at once interested and will never forget it when the time comes.

If that patient is in a different city and must lose his teeth, he will recall that you have something relating directly to his individual case which no other dentist in the world has, and, if it is humanly possible, he will come back to you for that service. If it is impossible for him to return, he will tell his new dentist and have him send for your records. I personally believe that there should be no charge for making such records, and that it should be included in the denture fee, except where the records are turned over to someone else, when a reasonable fee is justified.

In my opinion, the best method of obtaining these preextraction records is the technic used by Bert L. Hooper of Lincoln, Nebr. An Eastman clinical camera is used. Several front and profile views are made of the patient, as follows: 1. Front and profile views, life size, with the lips closed. 2. Front and profile views, life size, lips separated, showing the natural teeth. 3. Front and profile views, life size, teeth exposed and separated about one-eighth inch. 4. Front and profile views, one-half life size, showing individual characteristics of the patient.

The profile view, life size, with the lips closed, is cut with shears along the line of the face. The part with the profile outline can now be placed over the face at the median line, acting as a definite guide to the vertical dimension and other factors relating to fullness of lips and esthetics in general. The size, form and arrangement of the teeth are shown in the front view photographs. The

overbite, overjet and prominence of the teeth are shown in the lateral, or profile, views. The shade or hue of the teeth is recorded. All records are filed in a convenient envelope bearing the patient's name.

This method, which gives the dentist about all the needed information, is not expensive, and the record is easily filed for reference.

The psychologic effect on the patient when he sees the extent to which the dentist goes to furnish him individual service is very beneficial, his confidence being won and an appeal made to his spirit of cooperation.

Although the camera mentioned is perhaps one of the most convenient for this purpose, it is by no means the only one that can be used. Any small camera is satisfactory, but there will be the additional labor of making enlargements. This is best accomplished, perhaps, by placing a millimeter rule beside the patient's face, and then enlarging the print until the markings on the millimeter rule in the picture are brought up to scale.

There are many other methods of recording preextraction records in use. The x-ray profile, as used by F. J. Martin, of Medford, Wis., is one of the most popular. Labial compound impressions and casts are frequently used. Various facial measurements may be recorded and used to good advantage.

Often, we see combinations of two or more of these methods. All of the technics are good, but, in my opinion, the photographic method of Hooper far surpasses all the rest.

It is unfortunate that a large majority of the exodontists have yet to learn of the advantages of preextraction records. This is not entirely their fault. The trouble reverts again to the dentist who fails to cooperate with the exodontist and refuses to explain his needs and demand that they be met.

Frequently, patients wander into the exodontist's office without being referred there by a dentist. The patient may not even know to whom he intends to go for his denture service. In such cases, it should be routine practice on the part of the exodontist to make these preextraction records and deliver them to the dentist constructing the case.

We are all aware of the fact that all natural teeth are not the same size and shape; therefore, tooth form is of vital importance in esthetics. Here, I wish to pay my respects to the valuable work along this line done by J. Leon Williams. Dr. Williams was, without a doubt, one of the greatest artists, as well as scientists, that ever graced the dental profession. Our debt to him can be paid in no better way than by striving to put into practice the principles that he gave to us. His theories, if placed in practice, will add much to any practice. I am ready to accept the theories of Williams as facts. It is my opinion that the commercialization of this work has, to some extent at least, distorted it and cast a cloud over its value because of its use as advertising propaganda.

It is not my purpose here to discuss tooth form at any length, but it would not be entirely out of place. I shall say only that teeth should be selected for artificial dentures with the utmost care and then altered by grinding to fit the peculiarities of the case. Every set of artificial teeth requires some alteration before they will harmonize perfectly. It may be nothing more than the squaring off of the incisal edge to imitate abrasion or wear, or it may mean extensive grinding. Nevertheless, some change is always necessary.

The color or hue of the artificial tooth to be used is of the utmost importance.

It may be surprising to you to learn that there are many, many dentists who never consider it necessary to use more than two or three different shades of artificial teeth in their denture practices. This in itself casts a shameful reflection on the profession. On the other hand, many of the more meticulous operators find it necessary to use three or four different hues of artificial teeth on one denture case before the desired esthetic effect can be secured.

In selecting the correct hue or combination, it is essential that the operator have a definite appreciation of color values and color harmony. When an error is made in this work, it is almost always in the selection of a tooth that is too light in color.

Artificial teeth must harmonize with every color that goes to make up the features of the patient. The hair, eyes, skin and lips should all receive the utmost consideration. An example of this color harmony might be illustrated as follows: Suppose you were to enter a room in which the entire color scheme is a harmonious blending of pink. The curtains, drapes, wall covering, floor and furniture coverings, everything, in fact, is a perfect blending of different intensities of pink. Over in one corner is a small silk cushion that is a brilliant green. The moment you enter the room, this cushion is conspicuous. It seems almost to strike you in the face by its contrast. No matter where you look, you are always conscious of its presence. Now, if this offending pillow is removed, and one substituted in its place of a delicate shade of pink, you might live in this room for a week and never know that the pillow was even in the room.

This is exactly the situation in regard to the color of artificial teeth. When they are not in harmony with the facial color combinations, the clash is immediately evident. When they are in harmony, the blending obscures them and aids in concealing their artificiality.

A few general fundamental rules for the selection of the proper hue might not be out of place here:

Never select a shade or hue in artificial light.

It is best to moisten the porcelain sample.

Test the hue in both direct diffused light and shaded light. This may be done by shading the face with a large piece of cardboard, constantly varying the intensity of the shadow by moving it to and away from the face.

Another method is to move the porcelain sample slowly back and forth from the lips or anterior part of the mouth, back to the posterior part of the oral cavity.

Never look directly at the porcelain sample shade, but rather view the face as a whole.

While holding the porcelain sample against the hair, look at the mouth or chin. While holding it close to one eye, gaze at the other eye. Place it against one cheek, and look at the other cheek, and so on. If it is in contrast, it will be plainly visible. If it is in harmony, it will blend into the color scheme and become almost imperceptible.

If the patient's face is tinted with cosmetics, these should be removed and the selection made to harmonize with natural conditions. Do not assume the responsibility of harmonizing your work with some of the freakish, artificial color schemes that are seen in your office.

Color is perhaps one of the most important factors in esthetics. This subject will profitably bear all the investigation given it. For further research along this line, may I refer you to the work of E. Bruce Clark, of Uniontown, Pa., who

has made valuable contributions to the profession in this science.

The subject of tooth arrangement and its relation to esthetics cannot be overstressed. Here, the operator has perhaps his greatest opportunity for expressing his individuality.

Artificial teeth should not be set with too great regularity, nor too great irregularity. To put it another way, they should not be too beautiful, nor too ugly.

There are few things more humiliating to a denture wearer than to have some one at first compliment him highly on his beautiful teeth, and then apologize on noting, on closer inspection, that they are artificial.

Teeth that are unusually beautiful attract attention just as much as teeth that are unusually ugly. Both will stimulate unconsciously a closer inspection, and rare indeed is the artificial denture that will successfully pass close inspection and maintain its intended deception.

Certain types of irregularities are usually found in certain face forms. The lapping of central incisors or lateral incisors is found only in certain types. To place an irregularity of one type in another type would, in most instances, be quite obvious. There are times when it may be desirable to depart from natural typal conditions. For example, the incisal edge of the upper anterior teeth in the square type is usually almost a straight line. I believe that in constructing dentures this straight line should be broken by slight grinding, imitating the irregularities of wear. A straight line in such a case is always more attractive than a slightly broken line, be it ever so small.

It seems strange, but nevertheless it is a fact, that patients remember little about the arrangement of their own natural teeth, and most of what they do remember is wrong. It is unsafe to rely on them to any great extent for help in arranging artificial teeth to look like their own.

It is usually true that some near relative, or close friend, can tell much better than the patient when the arrangement most nearly approximates that of the natural teeth. It is good practice, whenever possible, to have such counsel while the anterior artificial teeth are being set up and tried in. It may save much argument later on, after the dentures are finished, both in your office and in the home. This friend, or relative, feels an exaggerated responsibility for the natural appearance of the dentures and accepts criticism somewhat as a personal insult and will defend his judgment and *your* dentures.

The use of a small hand mirror for the patient to inspect a trial set-up is ill-considered. Patients seldom, if ever, examined their natural teeth with such careful scrutiny, and any arrangement of artificial teeth will look strange to them. A large mirror placed at a rather inconvenient place in the office is much better, if a mirror must be used. This forces them to make a more natural inspection, of not only the teeth, but the whole face as well.

Dayton Dunbar Campbell, of Kansas City, has a very interesting psychologic treatment of this patient and mirror problem in the construction of artificial dentures.

In this problem of esthetics in denture construction, do not think that we are always attempting to duplicate the natural conditions of the patient. This is by no means always desirable or advisable. We should certainly not try to perpetuate deformities as they might exist in the patient, but should endeavor to improve the appearance in such cases, carrying through, perhaps, some faint characteristics, and, in the end-result, we will have a decided improvement without too much

of a change, which might be embarrassing.

The use of "plumpers" or "padding" on a denture is often advisable, but should never be used to extremes. There are few things more grotesque than the face of a 75-year-old woman built out to the plumpness of a 16-year-old girl. There are certain facial characteristics that always come with age, and these must be recognized and taken into consideration.

I cannot refrain from mentioning the use of some of the newer denture base materials in connection with esthetics. They mark a distinct step forward and add much to the appearance of dentures, especially in those cases wherein it is almost necessary to show the base material.

While I strongly favor the thermo-set type of material, and am still of the opinion that it is not yet out of the experimental stage, I do believe that when proper technical care is used, it is a safe material, and it should be employed in all cases wherein the patient can be led to appreciate its shortcomings and will cooperate with the operator in its care and use.

There is perhaps no one step in denture construction relating purely to esthetics that is more artistic and gratifying than porcelain staining. Here, we see the greatest possible outlet for artistic expression. I know of no condition of natural tooth appearance that cannot be duplicated to defy detection. It is unfortunate that this beautiful type of work has been restricted to so few members of the profession. It is true that the cost of this work is often prohibitive, but there is an almost unbelievable demand for this work, of which we know nothing. We are often too willing to place ourselves in judgment as to what the patient can or cannot afford. If the patient does not know of this work, he cannot be expected to ask for it. If we ourselves did not have an exaggerated idea of what such a service is worth, many patients would surprise us with their willingness to have it done for the added benefits of appearance. This is not a service which demands the additional fees often asked for it. It is unfortunate the manufacturers of artificial porcelain teeth do not supply us with more molds of their product, which can be stained without damage to either the porcelain or the pins.

It is not unusual to have patients request that one or more gold fillings be placed in the upper anterior artificial teeth when the denture is constructed. This request usually comes in those cases in which the natural teeth have carried fillings over a period of years and seem to have almost become a part of the person. A gold crown may be requested for the same reason. This is not necessarily bad practice, provided it is not carried to extremes. The placing of a gold crown on an artificial denture should be discouraged in practically every case. It is not only unsightly, but also, in many cases, interferes seriously with occlusion and articulation.

Immediate denture service offers much from the standpoint of esthetics. It is difficult to understand why a service so long in use, and with so many distinct advantages, is not practiced more. The retention of muscular tone in the facial muscles of expression, the ease with which natural conditions are duplicated, the maintaining of the vertical dimension and the protection, preservation and development of the ridge are only a few of the advantages offered by such a service. All dentists interested in the welfare of their patients, from the standpoint of not only esthetics, but comfort and efficiency as well, should do more of this type of work.

By immediate dentures, I do not mean those dentures constructed immediately after the extraction of the teeth, but con-

structed prior to extraction and inserted at the time of extraction.

If you are not rendering this service to your patients whenever possible, investigate it. If you have tried a few cases and had bad results, examine your technic critically.

Frequently, dentures are constructed that, at the time of insertion, may approach perfection from the standpoint of both esthetics and function. After they have been in service for a number of years, the supporting tissues undergo a decided change because of the increasing age of the patient, and the dentures are no longer suitable. In such cases, the dentures should be remade and the slowly acquired abnormal conditions corrected. Patients should never be given the impression that originally satisfactory dentures are permanent. A dentist who neglects to observe this degenerative change in his denture patients, and does not suggest its correction by reconstruction of the dentures, is not rendering the best type of service to his patients.

Every dentist who has constructed artificial dentures for any length of time unconsciously develops, or acquires, little tricks or short cuts that may or may not be worth passing on to the profession. Many of these relate more or less directly to the esthetic values of the case. Some operators whom I know remove the porcelain glaze from the anterior teeth and claim that the normal moisture of the saliva gives a much more natural appearance, particularly in artificial light.

In some cases, the patient raises the upper lip and exposes not only the necks of the teeth, but also a small amount of the denture base material, a condition which can frequently be improved by the grinding of a concave groove in the labial surface of the anterior teeth just below the neck. This has the appearance of erosion when at all noticeable, and acts as a lip trap. In other words, the lip slides up the labial surface of the teeth and comes to rest in the slight groove in place of going higher and exposing base material.

Denture construction has changed much in the last few years. There is a constant demand for better service, due partially to the change in the type of denture patient. We not only have now the person who has no other choice but to wear dentures, but we also have the patient who, a few years ago, would have chosen to spend large amounts of money for extensive crown and bridge restorations, and now, because of his fear of infection, chooses what he considers a safer path and elects to wear full dentures. These patients especially demand all that is possible in the replacement of their teeth. They not only demand physical comfort, but mental comfort as well. Mental comfort can be brought about only by the incorporation of esthetic values into denture construction.

What, then, can the dentist do to improve or develop his artistic ability and thereby increase the esthetic effect of his denture service?

First, may I suggest that he develop or acquire a hobby. Make that hobby something relating to art. Painting develops color appreciation, and modeling with clay promotes a sense of form. If there is an art school in the community, join an evening class in these subjects and find an interest and pleasure awaiting you that will be surprising. If such a course is not available, self instruction can become very fascinating and will produce wonders.

Study tooth form and arrangement and their relation to face form. These will all help immensely, and, above all, try at all times to inject as much art as possible into denture construction. The economic value of such an effort will be amazing. Few other opportunities offer greater pos-

sibilities as practice builders, and give greater returns in pleased patients and personal satisfaction.

When esthetics fully takes its deserved place in denture construction, and not until then, will dentists be rendering denture service and not be constructing just "false teeth."

CARE OF THE FIRST PERMANENT MOLAR: PRESERVATION OF THE MESIAL SURFACE UNTIL THE ERUPTION OF THE SECOND BICUSPID*

By GEORGE E. MORGAN, D.D.S., F.A.C.D., Milwaukee, Wis.

THAT the first permanent molar is the most important tooth in the mouth has been broadcast far and wide by the members of our profession. I do not agree with this theory. On the contrary, I believe that all teeth are of equal importance, and especially is this true during childhood. This is not said with the thought of minimizing the value of the first permanent molar, but rather to stress the importance of all the teeth, since the condition of one has a direct bearing on that of the others.

It is true that the treatment necessary for the preservation of the first permanent molar varies in some respects from that of any other tooth. In considering the treatment of the mesial surface of the first permanent molar until the eruption of the second bicuspid, let us review the calcification of the permanent teeth, as shown in the accompanying table, and see the relationship which the first permanent molar bears to the other teeth as to position and formation.

TIME OF BEGINNING OF CALCIFICATION OF THE PERMANENT TEETH
(Logan and Kronfeld)

Upper Jaw	3–6 Months	1 Year–15 Months	3–6 Months	1½–2 Years	2–2½ Years	1–4 Months	2–2½ Years	7–9 Years
Tooth	1	2	3	4	5	6	7	8
Lower Jaw	3–6 Months	3–6 Months	3–6 Months	1½–2 Years	2–2½ Years	1–4 Months	2–2½ Years	7–9 Years

The first permanent molar begins to calcify from the first to the fourth month after birth and the second bicuspid from two to two and one-half years after birth. The difference in the time of beginning of calcification of these teeth is approximately two years.

The crown of the first permanent molar is formed by the union of the lobes of calcification. The mesial surface is made up of the mesiolingual and the mesiobuccal lobes, forming a slight groove

*Read before the Section on Preventive Dentistry, Children's Dentistry and Mouth Hygiene at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1935.

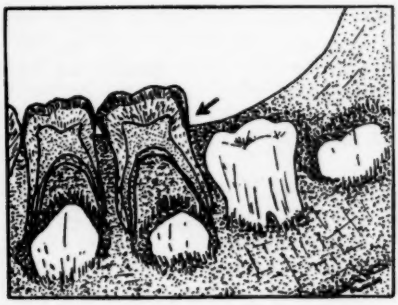

Fig. 1.—Carious distal surface of second deciduous molar. This should be carefully examined for etching or caries before the first permanent molar erupts.

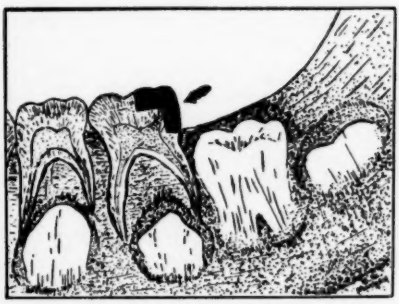

Fig. 2.—Treatment of carious distal surface of second deciduous molar. The filling should be polished to provide a smooth contact for the first permanent molar when it erupts.

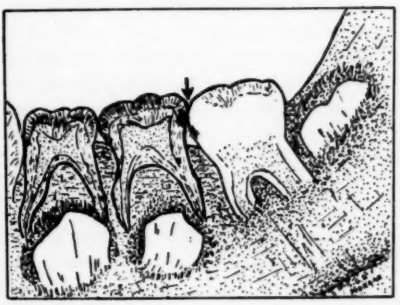

Fig. 3.—Caries in distal surface of second deciduous molar and mesial surface of first permanent molar.

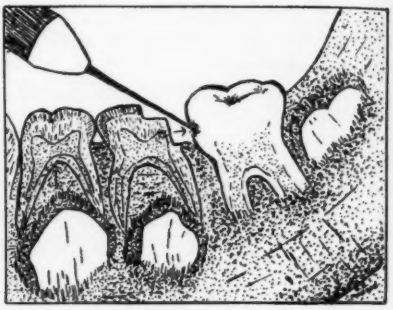

Fig. 4.—Method of cavity preparation.

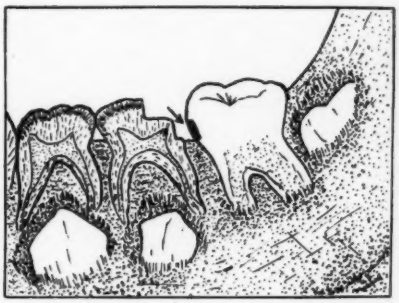

Fig. 5.—Silver amalgam in mesial surface of first permanent molar. This should be well polished before filling of the distal cavity in the second deciduous molar.

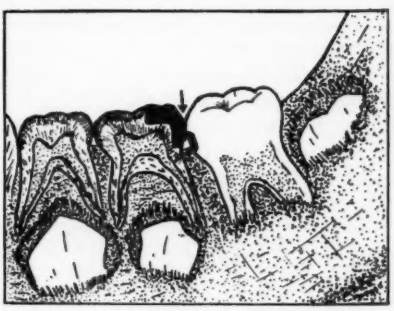

Fig. 6.—Cavities correctly filled.

Fig. 7.—Proper restoration of mesial surface of first permanent molar and distal surface of second deciduous molar.

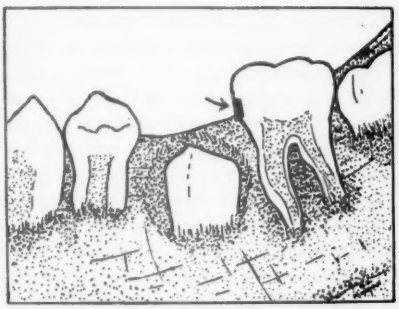

Fig. 10.—Period in dentition affording opportunity to place gold foil in mesial surface of first permanent molar.

Fig. 8.—Caries in distal surface of second deciduous molar (no permanent successor) and mesial surface of first permanent molar.

Fig. 11.—Gold foil filling placed in mesial surface of first permanent molar before eruption of second bicuspid.

Fig. 9.—Case in which gold fillings are indicated.

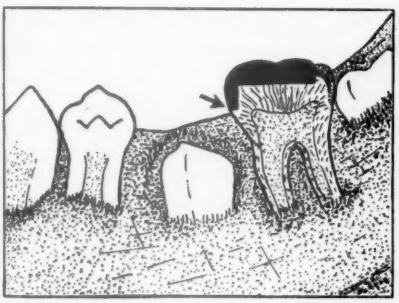

Fig. 12.—Mesioclusal inlay placed prior to eruption of second bicuspid.

or depression running from the mesioclusal "spillway" to the gingival aspect. This I shall refer to as the mesial groove.

The first permanent molar erupts from the fifth to the seventh year and the second bicuspid erupts from the tenth to the twelfth year. We see that while there is only two years' difference in the beginning of calcification of these two teeth, there is six years' difference in their eruption.

I shall divide these six years into three periods of treatment for the preservation of the mesial surface of the first permanent molar as follows:

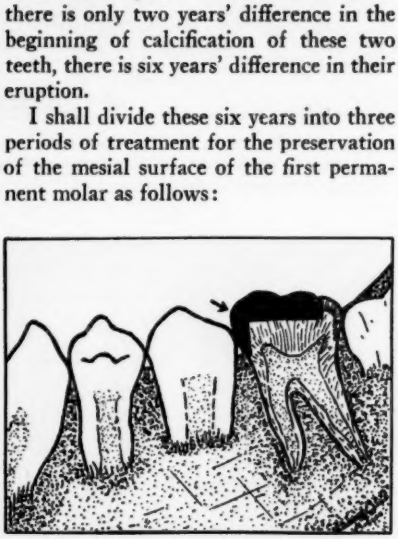

Fig. 13.—Second bicuspid in contact with well-polished mesial surface of first permanent molar.

1. Consideration of the distal surface of the second deciduous molar immediately prior to the eruption of the first permanent molar.

Caries seldom occurs on the distal surface of the second deciduous molar prior to the eruption of the first permanent molar because this surface is self-cleansing. The distal surface of the second deciduous molar should always be carefully examined for an etched or carious surface (Fig. 1). If the surface is only etched, polishing will provide a smooth contact for the first permanent molar on eruption. On the other hand, if decay has occurred, the cavity should be properly prepared by a compound distoclusal cavity and the use of a permanent filling material such as silver amalgam or gold inlay, the operator making certain that the distal surface is well polished to provide a smooth contact for the mesial surface of the first permanent molar on eruption (Fig. 2).

2. Treatment of the mesial surface of the first permanent molar from the time of its eruption to the exfoliation of the second deciduous molar.

After the eruption of the first permanent molar, we may expect to find decay on the distal surface of the second deciduous molar and the mesial surface of the first permanent molar somewhere along the mesial groove usually at or slightly below the point of contact (Fig. 3). If these cavities are small, they can be treated in the following manner: First, prepare the cavity in the distal surface of the second deciduous molar for a compound distoclusal filling. This will provide access to the mesial surface of the first permanent molar, which can then be prepared as a simple proximal cavity (Fig. 4). This cavity is then filled with silver amalgam (Fig. 5), which may be changed after the exfoliation of the second deciduous molar to a gold foil. This makes an adequate filling when polished and, at the same time, conserves the tooth structure.

At the next sitting, the filling on the mesial surface of the first permanent molar can be polished well. Then, the cavity in the distal surface of the second deciduous molar is filled with silver amalgam (Figs. 6 and 7), or if the second deciduous molar has no permanent successor (Fig. 8), gold fillings (Fig. 9) are indicated.

3. Treatment of the mesial surface of the first permanent molar from the exfoliation of the second deciduous mo-

lar to the eruption of the second bicuspid.

This period affords an excellent opportunity to restore the mesial surface with a permanent filling because of its accessibility (Fig. 10). Sometimes, on the exfoliation of the second deciduous molar, etching and a slight chalkiness is present at the point of contact of the mesial surface of the first permanent molar. If this condition is very superficial and has not penetrated the enamel, slight polishing will correct it. More frequently, we find that decay has occurred and has definitely penetrated the enamel and extended into the dentin. If the cavity is small and does not go near the occlusal surface, a gold foil filling (Fig. 11) should be inserted. If the cavity is large and extends near or includes the occlusal marginal ridge, a mesioclusal gold inlay (Fig. 12) should be placed. In either event, the mesial surface should be polished well to provide a smooth contact surface for the distal surface of the second bicuspid on eruption (Fig. 13).

Some have advised the treatment of the mesial surface when only slightly etched by the application of silver nitrate. I do not believe that silver nitrate has sufficient penetrating power as regards the enamel to be of any value.

I am not unmindful of the fact that there are abnormal conditions that must be treated individually, such as premature loss of the second deciduous molar prior to the eruption of the first permanent molar, or the submerging of the second deciduous molar after the eruption of the first permanent molar prior to the eruption of the second bicuspid, as well as other conditions which may necessitate special attention for the preservation of the mesial surface of the first permanent molar.

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DENTAL CARIES: CRITICAL STUDY OF INVESTIGATIONS IN THE HAWAIIAN ISLANDS*

By ALEX J. KER, D.D.S., San Francisco, Calif.

IN recent years, a great deal of work has been done in an effort to discover the underlying cause of dental decay, or perhaps more correctly, the factor or factors in the phenomena of susceptibility and immunity to dental decay. Different races and groups of people all over the globe have been studied with respect to their dental conditions and their environment and attempts made to correlate the findings in each case. A tremendous amount of animal experimentation has been carried out. Groups of children in various institutions under the best of conditions have been observed, and the findings recorded. Out of this vast amount of work has come a wealth of data which have added immeasurably to the sum of human knowledge; but out of it also have come, perhaps inevitably, a great number of theories as to the cause of this most common of human ailments.

*Read before the San Francisco Section of the International Association for Dental Research, Feb. 28, 1935.

*From the Department of Dental Medicine of the College of Dentistry and the George Williams Hooper Foundation for Medical Research, University of California.

The result of this has been that there is at present little but confusion in the minds of most members of the profession regarding this subject and in the minds of others some very set ideas in favor of the particular theory to which they adhere.

Hanke,[1] as a result of his investigations, feels that vitamin C is the significant protective factor. McBeath[2] appears to have demonstrated that vitamin D is the important agent in conferring immunity. Grove and Grove[3] draw attention to the ammonia content of the saliva as having an important relationship. Hawkins[4] feels that the imbalance of the serum calcium and phosphorus ratio is of prime significance as a factor in susceptibility both as to dental caries and as to pyorrhea. Mellanby[5] attributes susceptibility to vitamin D deficiency together with a low calcium intake and the consumption of large amounts of cereals, because, in her opinion, these foods have an anticalcifying power. And a number of others might be mentioned. It appears that the truth lies hidden behind a maze of variables and, when discovered, it will possibly be found to consist, not of any one factor, but of a number of factors operating with varying intensity in different individuals or groups of individuals.

Recently, some very interesting work was done in Hawaii by Jones, Larsen and Pritchard[6] purporting to show that the acid-base balance of the tissue fluids is the fundamental factor involved. This latest of theories has created so much interest in professional circles and has been the cause of so much controversy that it has been thought worth while to review it briefly.

A tremendous amount of effort has been put forth and much valuable information has been obtained. The Islands offer a peculiarly favorable opportunity for a survey of this kind. There is an abundant supply of material available for study, and the inhabitants, particularly the children, are found to be extremely susceptible to dental decay. The results of this work were published in a series of papers in 1930, supplementary data appearing in later publications.

It is the purpose of this paper to review this work in conjunction with that of other investigators in the same field, and to present the findings so that comparative estimates can be made. While, in a sense, this is a critical review, a better term perhaps would be a comparative review with the purpose of making possible an evaluation of the findings. It need hardly be pointed out that the findings of these investigators are not at any time in question, but the possibility of experimental error and the interpretation of the findings are, and should be, proper subjects for discussion and criticism. It is one of the aims of this paper

1. Hanke, M. T.: Diet and Dental Health, Chicago: University of Chicago Press, 1933.

2. McBeath, E. C.: Experiments on Dietary Control of Dental Caries in Children, J. D. Res., 12:723 (Oct.) 1932; Nutritional Control of Dental Caries, New York J. Med., 33:1086 (Sept. 15) 1933; Vitamin D Studies, Am. J. Pub. Health, 24:1028-1031 (Oct.) 1934.

3. Grove, C. T., and Grove, C. J.: Biochemical Aspect of Dental Caries, D. Cosmos, 76:1029-1036 (Oct.) 1934.

4. Hawkins, H. F.: Rational Technique for Control of Caries and Systemic Pyorrhea, J. D. Res., 11:201-219 (April) 1931.

5. Mellanby, May: Experiments on Dogs, Rabbits and Rats, and Investigations on Man, Which Indicate Power of Certain Food Factors to Prevent and Control Dental Diseases, J.A.D.A., 17:1456-1480 (Aug.) 1930.

6. Jones, Martha; Larsen, N. P., and Pritchard, G. P.: Dental Diseases in Hawaii, D. Cosmos, 72:439-450 (May), 574-577 (June), 685-699 (July), 797-810 (Aug.) 1930; Taro and Sweet Potatoes Versus Grain Foods, in Relation to Health and Dental Decay in Hawaii, ibid., 76:395-409 (April) 1934.

to make such discussion and criticism possible, for it is thus that interest in such work is stimulated.

One of the essential features of this series of papers is the fact that the teeth of the children living in Hawaii have been observed to be susceptible to a particularly rampant form of decay, which the authors term "odontoclasia." This form of decay is described as being a "rampant disintegration of the crown of the tooth." It occurs on all surfaces of all teeth, the deciduous set being affected primarily. The initial lesions usually appear as soft, chalky spots near the incisal edges on the lingual and labial surfaces of the anterior teeth. In many teeth, the incisal tip is the first to disintegrate and, on the other hand, this part will remain intact while the middle third of the tooth disintegrates rapidly. Oftentimes, the crowns of the molars appear to be lost, as through attrition, leaving a smooth surface of dentin exposed. At this stage, the process frequently becomes static, and the dentin, sometimes flat, sometimes in pyramid formation, remains practically intact for an indefinite period. The lesion begins in the enamel surface and progresses inward in parallel fronts.

In some cases, the surface enamel only is affected; in others, it has been completely disintegrated in large slabs, the underlying dentin matrix remaining intact, and, in still others, the dentin is penetrated to varying depths. The form of the tooth and its proximity to other teeth do not appear to be factors in the development of this type of lesion. It occurs spontaneously in the teeth of Island born puppies, the canine teeth which, by virtue of their conical form and position in the dental arches are peculiarly resistant to caries, being particularly susceptible. A plan was formulated to study this particular type of decay and, if possible, to discover the etiologic factors involved. About 2,000 children were examined. Heights, weights and physical findings were recorded for most of these. "All information possible in regard to diet was obtained." As a result of these dietary studies, the conclusion was reached that, among other things, the diet of these children is as a whole potentially acid in reaction; that is to say, the ash of the diet when burned in the body would result in a preponderance of acid rather than basic constituents. The diet of the Island born puppies whose canines are observed to be particularly susceptible to "odontoclasia" was apparently not studied.

Various factors, both dietary and environmental, were given consideration as being possibly responsible for the susceptibility or immunity of the enamel to decay, but it was felt that the potential acidity or alkalinity of the diet was the principal underlying cause of these two phenomena.

And so the conclusion was reached that "all the evidence indicates that dental decay is primarily a systemic disorder, an imbalance, perhaps, in the tissue fluids and oral secretions in the direction of a decrease in basic ions, either relative or absolute" and "it is believed that any type of diet, any factor or combination of factors which tend to decrease the relative or absolute amount of base in the tissue fluids will proportionately increase the liability of the enamel to decay." Again, "The activity of the decay process is in a state of flux and appears to bear a direct relation to the acid-base balance of the blood," and "Dental disease (decay and alveolar atrophy) is a systemic disorder, an imbalance in the tissue fluids resulting from varying intensities of the factors which regulate neutrality in the body."

The first question which arises in a

consideration of this theory is as to whether these conclusions apply only to "odontoclasia" or they can be applied to dental decay, as the term is generally understood. In the early papers, great pains are taken to differentiate "odontoclasia" and caries, and the earlier statements seem to apply principally to that particular form of tooth disintegration observed in children in Hawaii. But, as the discussion proceeds, it would appear that the theory gains momentum, so to speak, until it embraces not only alveolar atrophy but caries as well. For, as we continue, we find frequent reference to "dental decay" and to "susceptibility of enamel to decay." And we read in the last paper of the series that "though odontoclasia and caries differ in certain respects, the mechanism of the decay processes are probably the same," and "both apparently are associated with a relatively high acid content of blood plasma."

We may take it, then, that the theory propounded applies not only to that atypical form of tooth disintegration observed in the children of Hawaii, but also to dental decay, as the term is generally understood. This is the impression conveyed by the authors and, from the foregoing statements, it appears that this was intended.

If this theory can be shown to be based upon irrefutable evidence, these authors will have made the most important discovery in the history of dentistry. For it means that, by keeping the diet on the alkaline side, as by the administration of small amounts of sodium bicarbonate, we not only can control caries but also can confer a positive immunity in any given case.

Before we accept this theory, we must be sure that the evidence supporting it is sound and sufficient. It is one of the purposes of this paper to examine this evidence and to evaluate its interpretation. We should like to emphasize again that while, in the course of this paper, we may question certain statements of fact, it is not the findings of these observers about which we have any doubt—in fact, some of them are extremely interesting—but the degree of significance of these findings and their interpretation, as well as the conclusions reached.

In the first place, while we are aware of the tremendous amount of time and effort involved in a dietary survey of the type conducted by these authors, we are bound to point out the possibility of erroneous conclusions being reached in such a survey, in spite of the painstaking care exercised in the collection of the data.

Great stress is laid on the fact that most of the children are breast fed and yet are peculiarly susceptible to dental decay. On the basis of this, it is postulated that the child's diet is adequate in minerals and other essential factors. That the calcium as well as the phosphorus content of mother's milk varies among different groups has been amply demonstrated. Burhans and Smith,[7] on examination of thirty-four samples from colored and white mothers, found that the calcium content of colored mothers' milk was 17 per cent less than that of milk from other races. Whether this was due to some dietary deficiency of the mothers or to some intrinsic factor in the mother herself, it is difficult to say, since it was found difficult to modify appreciably the calcium in the milk by supplementary additions of calcium to the mother's food. The point is that mother's milk *per se* cannot be taken as a standard, but can, among certain groups, be a decided variable, and it is of great impor-

7. Burhans, C. W., and Smith, D. N.: Inorganic Constituents of Human Milk with Particular Reference to Racial Variations, Am. J. Dis. Child., 26:303-308 (Oct.) 1923.

tance that this variable be given consideration in studying the effect of the diet of the children on their body tissues.

In a subsequent publication, an account is given of the substitution of cow's milk for mother's milk, with no apparent improvement in the dental conditions; but no record is made of any analyses having been made of either the mother's milk or the cow's milk which might serve as the basis of a comparison of their nutritive values.

Again, the questioning of the mothers, the visiting of the homes and the examination of the charge accounts at plantation stores in a general way would give a cross-section of the dietary habits of the families and, where food purchases were obviously inadequate, it would indicate that the children were not receiving a satisfactory diet. But the possibility of being misled and the difficulty of obtaining really accurate data by this method are obvious. It is quite possible for the charge accounts at the store to show a balanced selection of foods and yet to find the diet of the children totally inadequate with respect to certain factors. It would seem that only rough approximations could have been reached as regards the actual nutritive values of these diets. Indeed, it is very difficult to draw any definite conclusions from the data given as to the relative constituents of the diets. The authors apparently experienced the same difficulty, for it is stated that "it is impossible to even estimate the composition of the diet as a whole," and that "the predominance of rice, however, makes it certain that it is high in carbohydrate and potentially acid in reaction." It is stated that out of a group of 779 Japanese city children, only two were caries free and an investigation showed that fruit and vegetables constituted the bulk of the food in both cases. It is assumed that these two children were rendered immune to decay because of the preponderance of alkaline ash producing factors in their diet. It is almost unbelievable that of the 779 children, these were the only two who were on this type of diet. Yet we have only to point to two cases of rampant decay in children whose diet contained abundant fruit and vegetables to show that the assumption can very well be false.

The inclusion of poi and sweet potatoes in the diet is considered from the standpoint of their value as alkaline ash producing foods; but we must also remember that a plentiful supply of these foods raises the calcium content of the diet considerably, as well as the potassium content, the figures for the ash constituents of sweet potatoes and rice being 0.019, as compared with 0.009 per cent calcium, and 0.397 as compared with 0.070 per cent potassium. It would be necessary, too, to know something of the ease of assimilation of minerals from these foods. That calcium is more readily assimilated in the form of some salts than in the form of others is well known. Is it not possible that this factor of assimilation is introduced here?

Some findings in this regard which have been published are very convincing. One hundred and seventeen babies from 12 to 15 months of age were studied with respect to their diet and their dental conditions. The first group, consisting of sixty-four cases, were fed on Diet I, consisting of mother's milk, rice, bread and cereal. The number of teeth erupted was 576 and the number decayed 265. The second group, consisting of eleven cases, were fed on Diet II, consisting of cow's milk, rice, bread and cereal. The number of teeth erupted was 98, the number decayed 49. The third group were fed on Diet III, consisting of cow's milk, poi, sweet potatoes and rice. The number of teeth erupted was 374 and the number

decayed 15. These are the findings over a period of three months. We assume, of course, that these are not selected cases.

These findings obviously indicate that some vital change has been brought about in the organism, one of the effects at least of which is an astonishing improvement in dental conditions. What is the explanation? What factor or factors have been varied to account for these results? Can these findings be duplicated in other groups of children of a different social status or of different racial origin and environment?

The explanation of these findings given by the authors is that the addition of poi and sweet potatoes has raised the potential alkalinity of the diet, resulting in a raising of the alkali reserve of the tissue fluids, and thus conferring immunity to decay. It must be granted that this is a very plausible explanation and, in some of the cases cited, an equally plausible one is difficult to find. It would be extremely interesting to discover whether, other things being equal, the addition of small amounts of sodium bicarbonate to the diet of these children would show the same results. If not, we must assume some specific type of alkalinity in poi and sweet potatoes; which is equivalent to saying that it is not the potential alkalinity of these foods as such that is conferring immunity, but some other factor, and this leaves the whole theory without foundation.

It has been shown by McCollum, Simmonds and co-workers[8] that sodium bicarbonate added to a seed plus casein diet in rats did not produce optimum well-being; whereas, small additions of calcium carbonate with either cod liver oil or butter fat, depending on the amount of calcium added, produced excellent growth and high fertility. In answer to the question, "To what may rampant tooth decay be attributed in a child whose diet contains one quart of cow's milk, an egg, fresh fruit, vegetables and meat daily, in addition to cereals and other foods?" we are told that the cause is probably an "acidotic constitution" of the child; which means a relative or absolute decrease in the child's alkali reserve. If this is correct, the obvious remedy suggests itself. But can the child's alkali reserve actually be shown to be low? Furthermore, can immunity to decay be conferred, not by a change in the diet or in the environment, for other variables may be introduced in that way, but solely by the addition of sodium bicarbonate to the diet? These would seem to be important questions, and it should be possible to find an answer to them.

Is it the potential alkalinity of the poi and sweet potatoes that accounts for these cases of caries immunity? Is it the increase in vitamin B content which is an important factor in the assimilation of calcium? Is it a matter of the greater ease of assimilation of calcium from poi and sweet potatoes than from these other foods? Is it some endocrine factor? Is it some environmental factor that has not been taken into account? Or is it a combination of all of these? There is not enough evidence here to say definitely.

As a further illustration of the possibilities for inaccuracy in this type of dietary survey, the authors state that "when burned in the body, human milk leaves a neutral ash and cow's milk leaves an alkaline ash." According to Sherman's figures,[9] the opposite is true. The ratio of potential acid to base, calculated from Sherman's values, is approximately 1:1.5 for cow's milk and

8. McCollum, E. V., et al.: Studies on Experimental Rickets, J. Biol. Chem., 50:5-30 (Jan.) 1922.

9. Sherman, H. C.: Chemistry of Food and Nutrition, New York: MacMillan Company, 1928.

1:3 for human milk. In fact, Marples and Lippard,[10] in their experiments on the influence of cow's milk on the acid-base balance of the blood of new-born infants, substituted cow's milk for human milk with the very purpose of changing the diet from the alkaline to the acid side.

While the authors' conclusions that, as a type, the diet is potentially acid rather than alkaline may be correct, so many other factors remain unchecked, and there is such a lack of control that we cannot but feel that the ground is too insecure to serve as the basis for a theory. Certain other conditions are given consideration and eliminated as having no bearing on the problem. The vitamin content of the diet is considered and ruled out as a factor in immunity. It is stated that "when supplied in the form of cod liver oil, of eggs or of milk, both human milk and fresh unpasteurized cow's milk, orange and tomato juice, the vitamins failed utterly to prevent the rampant disintegration of the teeth of babies born in Hawaii," and this is later extended to the statement that "it would seem that the vitamins in excess of a certain amount essential for life and growth are not necessary for the preservation of enamel." It is notable that the claim is not made that these accessory food substances are not necessary for the development of sound enamel, although this is no doubt what is meant; for we are told earlier that the enamel of the teeth of these children is "chalky and easily scraped" when the teeth first erupt. We are not told for how long these food substances were administered and in what quantities. In fact, it is admitted that "the amount actually taken is a matter of conjecture." It has been assumed that on account of the plentiful supply of tropical sunshine, the children received the D factor in abundance. This is no doubt true, but the possibility of error in interpretation lies in considering this one factor by itself in a very general way and ruling it out. An abundant supply of vitamin D with a very low calcium diet will hardly result in a well-developed osseous structure. On the basis of having fed cod liver oil in good measure to a child on a low calcium diet and finding faulty bone structure, we would hardly be justified in assuming that vitamin D is of no importance in the development of sound bone, yet this is precisely the method of reasoning that has been followed in arriving at these conclusions.

The relationship of vitamin D and mineral metabolism is probably not to be expressed as a direct proportion; that is, the more generous the supply of vitamin D, the better the utilization of the minerals ingested. It is evidently more complex than this. Some interesting work illustrating this point has been done by McCollum and his co-workers[8] in their nutritional experiments on animals. They found that cod liver oil, rich in vitamin D, added to a low calcium diet enables the animal to make a decidedly better growth curve, but the bones of these animals were found to be thin and fragile and poorly calcified. As far as growth was concerned, they appeared to be normal animals. The generous amount of vitamin D has made possible a normal growth curve, but at the expense of the proper calcification per unit area of bone, so to speak. The small amount of available calcium had to be distributed over a larger area. The substitution of butter fat, containing less vitamin D, for the cod liver oil protected the animal in a sense by inhibiting its growth, but produced shorter, more highly calcified bone. It is only on low calcium diets that this

10. Marples, E., and Lippard, V. W.: Acid-Base Balance of New-Born Infants, Am. J. Dis. Child., 45:294-306 (Feb.) 1933.

is apparent. On a high calcium diet, there is sufficient mineral available to keep up with a normal growth curve and produce normal tissue.

It seems from the foregoing that the optimum amount of vitamin D is not necessarily expressed merely as a generous supply. It is a factor related to other factors and dependent on them. It may well be that too generous a supply of this vitamin may work a definite injury to the organism, at least temporarily and as far as the teeth are concerned, perhaps an irreparable one, by maintaining a growth curve beyond the power of the organism to keep up with it. It is reported by the authors that the development of the long bones of many of these children in Hawaii appears to be beyond the chronologic age. This fact at least is in harmony with McCollum and Simmonds' findings in experimental animals.

That vitamin B is not concerned in dental decay is based upon the evidence of the extraordinarily sound teeth in people who have been subject to beriberi. How the fact that people, living largely on polished rice, a highly acid diet, develop extraordinarily sound teeth fits in with the authors' theory of the cause of dental decay, we are at a loss to explain.

We cannot but feel that the work of such investigators as Mellanby, McCollum, McBeath, Anderson and Williams *et al.* has been disposed of in a rather summary fashion. It is true that McCollum,[11] in summing up our knowledge of the relationship of these accessory food factors to the teeth, says that "there can be no reasonable doubt that there is a close relationship between vitamin D and the structure of the teeth," but he adds "that no final conclusions can be drawn at present concerning the exact relationship of diet and dental disease." Therefore, while science is at present somewhat in the dark concerning the exact relationship between diet and dental disease, and, as McCollum says, no final conclusions can be drawn, we fail to see that evidence presented in this survey regarding the vitamins is sufficient to eliminate them as a factor in this problem.

It must be remembered that the body of the very young child is relatively calcium-poor and phosphorus-poor. The bones are soft and plastic and not fully calcified. Normal development, therefore, calls for a liberal supply of these elements. This may well apply to the enamel of the teeth, as well as to other hard tissues, at least during its developmental stage. Furthermore, it has been shown that additional amounts of vitamin fail to prevent a retardation of this normal development if the calcium intake remains low. Not that this mineral deficiency may necessarily be great enough to give rise to clinical symptoms, but it may well evidence itself in the structure of the enamel. In other words, it is not that calcium intake is the one important factor, but that more than one factor must be given consideration at a time, or the number of variables in any given case can only give rise to confusion in the results.

Of course, the principal premise upon which this theory is based is that the ingestion of a potentially acid diet is capable of producing a change in the tissue fluids as evidenced by a decrease in the alkali reserve of the blood. As we know, the mechanism by which the neutrality of the tissue fluids is preserved is one of considerable complexity. Yet, while this mechanism is one of great delicacy in maintaining the p_H of the blood between normal limits, it is one of remarkable stability. When we realize that variations in the hydrogen-ion concentration

11. McCollum, E. V.: Relationship Between Diet and Dental Caries, J. D. Res., 11:553-562 (Aug.) 1931.

such as to produce a condition in which the blood is as acid as distilled water on the one hand or as alkaline as tap water on the other, are incompatible with life, we gain some conception of the efficiency of the regulating mechanism. Normal blood is slightly alkaline, having a p_H in the neighborhood of 7.35. And this p_H is stubbornly maintained in spite of the constant production of acid products in the body. The alkali reserve is the total bicarbonate present in the blood and is determined by the fixed carbon dioxide content of the blood at a given carbon dioxide pressure and temperature. The arterial blood of man normally contains about 50 per cent by volume of carbon dioxide, the venous about 55-60 (Van Slyke).[12] A complete discussion of the various means by which the neutrality of the blood is maintained is beyond the scope of this paper, but, in the light of the subject under discussion, it seems to be of the utmost importance to know whether this acid-base equilibrium can be affected, swung to the right or left, so to speak, by the ingestion of an acid or alkaline ash producing diet. That this is possible has been taken for granted by these authors. At least, we find no record of alkaline reserve determinations having been made on these children. It would be very interesting and would add immeasurably to the value of these studies if these data were added to those presented.

It is stated in a subsequent paper that the alkali reserve (combined carbon dioxide) of forty cases of normal adults was determined and was found to be between 50 to 60 per cent by volume. This is described as being low, although, according to Van Slyke's figures, this is well within the limits of normal. The urine reactions of four babies on a cow's milk formula were determined and found to be between p_H 5.0 and 6.0. The addition of poi, sweet potatoes, orange juice and vegetables in increasing amounts eventually resulted in a urine p_H of from 6.2 to 7.0. This would seem to indicate that the change in diet had resulted in a change in the acid-base balance of the tissue fluids. Although the reaction of the urine is variable over a far wider range than that of the blood, it is true that the two, except in special instances, vary in the same direction at the same time. Whether a change in reaction of the urine to this degree represents a permanent change in the acid-base relationship of the tissue fluids is open to some question. It can be shown (Scloss and Harrington)[13] that the ingestion of a more acid diet, resulting in a more acid urine in children, has actually caused a rise of the blood bicarbonate.

Considerable work has been done on this particular problem and apparently it has not yet been settled. Peters and Van Slyke[12] are of the opinion that the adjusting ability of the kidneys is so great that the products of normal metabolism cause hardly appreciable effects on the internal acid-base balance, as indicated by the plasma bicarbonate content and p_H.

Michalowsky[14] reported that feeding an acid diet to normal adults for from three to five weeks caused no diminution of the alkali reserve of the blood.

J. F. McClendon, L. Von Meysenburg, O. V. Engstrand and Frances

12. Peters, J. P., and Van Slyke, D. D.: Quantitative Clinical Chemistry, Baltimore: Williams & Wilkins Company, 1931.

13. Scloss, O. M., and Harrington, H.: Comparison of the Carbon Dioxide Tension of Alveolar Air and Hydrogen-Ion Concentration of Urine with Bicarbonate of Blood Plasma, Am. J. Dis. Child., 17:85-94 (Feb.) 1919.

14. Michalowsky: Alkalireserve und saure Kost, Klin. Wchnschr., 9:1505 (Aug. 9) 1930.

King,[15] with carefully controlled experiments, found that the alkali reserve of both man and dog is highly resistant to the influence of diet. Dogs on a highly acid diet for two months showed no change in the alkali reserve of the blood and man placed on acid-forming, then mixed, then base-forming diet showed no change whatsoever in alkali reserve of the blood.

Edward Tolstoi[16] found that a highly acid diet consisting exclusively of lean and fat meat failed to affect the carbon dioxide combining power of the blood of the subjects under study in spite of a daily ketonuria.

Fritz Bischoff,[17] in a recent careful review of the literature on this subject states that "in man the acid or alkali content of ingested foodstuffs is insufficient to produce a sustained shift of the acid-base equilibrium outside the limits of normal." Unpublished data of Bischoff, Long and Sansum show that the daily ingestion by an arteriosclerotic patient of sodium citrate equivalent to 18 pounds of oranges for a period of three months shifted the prebreakfast plasma p_H and total carbon dioxide of the blood just significantly outside the individual's control range, but not outside the normal group limits. The ingestion for a three-day period of protein foods containing an acid ash, the equivalent of from 2 to 5 pounds of beefsteak, failed to produce any effect on the acid-base equilibrium of the blood, although there was a marked nitrogen retention. It is likely that the ingestion of natural foodstuffs produces temporary changes in the acid-base equilibrium of the blood, but it is doubtful that these changes are so great as those produced by exercise and, therefore, that they are significant. Experimentation is complicated by the "alkaline" tide, which awaits investigation.

Morgan and Hatfield,[18] as a result of their studies of an alkaline diet in undernourished children, found a uniform gain in weight, but, upon the question at issue, reached no definite conclusions. They state that "the question of the possibly variable character of carbon dioxide combining capacity of the blood plasma with a state of digestive activity and with the acid-base equilibrium of ash of food just ingested is not yet answered."

Hasselbach,[19] on the other hand, showed that the carbon dioxide tension of the alveolar air is influenced by the diet. On a diet rich in meat, there is to be found a tension of 37.8 mm.; on an ordinary mixed diet, 38.3 mm.; on a vegetarian diet, 42.3 mm.

Marples and Lippard[10] found a slightly lower carbon dioxide content in the serum of new-born infants receiving cow's milk than in that of those receiving breast milk. They did not ascribe this definitely to the difference in the inorganic ash constituents of the milk, but pointed out that the change from breast milk to cow's milk may involve other factors besides the acid-base ratio of the ingested food. They did decide that changes in the acid-base equilibrium of the blood were more easily induced in

15. McClendon, J. F.; von Meysenburg, L., and Engstrand, K. F.: Effect of Diet on Alkali Reserve of Blood, J. Biol. Chem., 38:539-548 (July) 1919.

16. Tolstoi, Edward: Effect of Exclusive Meat Diet on Chemical Constituents of Blood, J. Biol. Chem., 83:753-758 (Sept.) 1929.

17. Bischoff, Fritz, et al.: Effect of Acid Ash and Alkaline Ash Foodstuffs on Acid Base Equilibrium of Man, J. Nutrition, 7:51 (Jan.) 1934.

18. Morgan, Agnes F., and Hatfield, Glatha D.: Effect of Various Supplementary Lunches on Plasma Carbon Dioxide Capacity of Children, Am. J. Dis. Child., 32:655-666 (Nov.) 1926.

19. Hasselbach, K. A.: Biochem. Ztschr., 46:406, 1912.

new-born infants than in either adults or children, although the underlying cause of this remains unexplained. From the foregoing, it must be admitted that this question is still in some doubt, with the weight of the evidence as yet against the proposition.

Leaving the question as to whether the acid-base equilibrium of the blood can be influenced significantly by moderate changes in the diet, we come to the more direct question of the relationship between this equilibrium and immunity to dental decay. If, as these authors state, the acid-base equilibrium of the tissue fluids is the one significant etiologic factor in dental decay, we must expect to find a correlation between the blood picture and the dental conditions. The authors' findings in this regard are extremely interesting: "No single case of active decay was observed in any child three years of age or over, whose diet contained fruits and vegetables in amounts sufficient to produce an alkaline ash, regardless of how it was otherwise constituted, or of his mode of living, . . . or exposure to sunshine." Furthermore, it is stated that they "have never known of a case of active caries in a normal individual who obtains from sixty to seventy per cent of the calories of his diet from poi and sweet potatoes"; that is to say, from an alkaline ash producing diet; the inference being that the potentially alkaline diet resulting in a modification of the acid-base equilibrium of the tissue fluids has conferred an immunity in all cases.

These findings are of the utmost significance. Their implications are so far-reaching that we are bound to wonder whether some vital factor may not have been overlooked or there has not perhaps been some misinterpretation of the data. If these findings can be confirmed by other workers, a contribution of inestimable value will have been made toward the solution of the problem of susceptibility and immunity to dental caries. Other workers, in seeking to confirm these findings, have as yet been unable to find such exact correlation.

Krasnow, Krejci and Karshan,[20] having made about eighty series of analyses of blood of students in Columbia University, found that "no differences exist in the alkali reserve of the blood as measured by the carbon dioxide capacity of the blood plasma," between those immune from and those susceptible to dental caries. A study of the p_H and carbon dioxide content of the blood plasma "likewise failed to show any difference between the various groups."

Boyd, Drain and Stearns,[21] in a series of metabolic studies of children with dental caries, found patients suffering from chronic acidosis and relatively immune to dental decay. They say, "The freedom from significant degree of dental caries noted in children with prolonged chronic severe acidosis would discount the significance of any degree of acidosis dependent upon the acid-base relationships of the ash of any ordinary diet." Further investigation of this phase of the problem seems to be indicated.

One more question naturally arises: Are the conditions described peculiar to the Hawaiian Islands alone or to its people? Would it be impossible to duplicate elsewhere the results there obtained? This point is touched on by the authors. It is explained that the physiologic effect of the warm climate produces an "acidotic constitution" in the individual, mak-

20. Krasnow, F.; Karshan, Maxwell, and Krejci, Laura E.: Study of Blood and Saliva in Relation to Immunity and Susceptibility to Dental Caries, J. D. Res., 11:573-589 (Aug.) 1931.

21. Boyd, J. D.; Drain, C. L., and Stearns, G.: Metabolic Studies of Children with Dental Caries, J. Biol. Chem., 103:327-337, 1933.

ing necessary a highly alkaline diet to produce optimum well-being. In the temperate zones, the degree of acidosis is not so great and the alkali requirements are correspondingly lower; whereas, in the arctic, the acid-base balance of the blood is such that a highly acid diet is desirable. Since the scientific justification for this explanation has not been definitely established (as the authors state that "data on the acid-base balance of the blood of normal individuals in the arctic and tropics are not available"), it must be classified as pure theorizing; but by virtue of the authors' hypothesis as to the reason for susceptibility to dental decay, it should be easier to control or prevent dental caries in the temperate climates where less alkalinity is necessary to produce the desired effect.

The use of grains in the tropics is condemned because of the deleterious effect of their potential acidity. "Grains yield an excess of acid elements which are well tolerated in cold climates but in the tropics create an imbalance in the systemic complex toward the acid side." Two sentences further on, we read, "The introduction of grain foods into the arctics and tropics has been associated with physical deterioration of the people and increase of susceptibility to diseases of all kinds and increase in the incidence of dental decay."

If we are to assume that the injurious effect of the consumption of grain foods in the tropics is the result of a combination of an "acidotic constitution" of the individual with the potential acidity of ingested food, to what are we to attribute its injurious effect in the arctic? Is the physiologic effect of a warm climate on the acid-base balance of the blood the same as that of a very cold climate? Does the Eskimo, as well as the Hawaiian, have an "acidotic constitution" and are grain foods injurious to them both for the same or for different reasons? Obviously, for the sake of logic, if we are to assume that a warm climate produces a certain degree of acidosis, so that the ingestion of grain foods, because of their potential acidity is injurious to the organism, we cannot assume the same sequence for a cold climate. The authors offer an explanation of this apparent inconsistency by stating "the association of dental decay with grain foods the world over is probably due not to a fault as such, in the grains, but to their excessive use out of their natural habitat." It seems that the authors' reasoning with regard to this question is somewhat confusing.

In conclusion, I should like to give full credit to the authors for the valuable work that they have done in this field. There is no question that much of what they have said may be an approach to the solution of this very great problem; but we cannot accept their hypothesis, as it stands, as the final word for the reasons that we have attempted to outline. The work of these investigators has done so much in arousing the interest of the profession in this question, perhaps unique for the Hawaiian Islands, that efforts will be made to check experimentally various phases of the problem that this work has suggested.

CORRECTION OF CLEFT LIP AND CLEFT PALATE*

By A. L. FREW, D.D.S., F.A.C.D., Dallas, Texas

THE correction of cleft lip and cleft palate is not in the experimental stage of a few years ago; for, when definitely well proven methods are properly applied, the results are good. We should select a technic that will assure satisfactory results, with the minimum number of anesthesias, as they are harmful to children if employed frequently.

I use the Brophy three-stage technic throughout lip and palate operations, with a few slight modifications. After more than 2,300 operations, I have no reason for changing, especially after observing the results obtained by other methods. With few exceptions, three operations will completely correct the most extensive deformity.

CAUSES

Much has been written as to the cause of cleft palate, but after going into the early pregnancy history of several hundred cases, I am still of the opinion that the cause is largely mechanical. The majority of these cases occur among the poorer class, in mothers who do unusually heavy work, especially during early pregnancy.

The tongue develops first, and immediately after this, the maxillary and premaxillary bones develop and are united to make the two maxillary bones, a process which is completed by the end of the eighth week of fetal life. I believe that it is possible for the maxillary bones to be held apart by the tongue or otherwise because of heavy lifting by the prospective mother, until it is too late for union to take place.

Heredity also plays a part in this condition. Quite often we have two and in a few cases three affected children in the same family, and the deformity may occur in several generations. I do not think syphilis or malnutrition plays any part.

AGE FOR EACH OPERATION

Most cases can be completely corrected at any age, or at least very much improved, but the most appropriate time for operation is during the first two years.

The first operation (Figs. 1 and 3), the closure of the alveolar ridge by the Brophy pressure method, consists of placing silver wire through the maxilla and through lead plates upon which the wires can be twisted, producing heavy pressure on the alveolar ridge, which approximates the points of the ridge in the anterior part. These points are freshened and held in contact for six weeks, during which time union takes place. This operation should be performed as soon after birth as possible. After 6 months of age, because of the solidity of the maxilla, it may be necessary to make a greenstick break in order to close the alveolar ridge.

The second procedure is the plastic

*Read before the Section on Oral Surgery, Radiology and Anesthesia at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1935.

Fig. 1.—Complete left side cleft of lip and hard and soft palate. The alveolar ridge was closed by the Brophy pressure method at the age of 2 months.

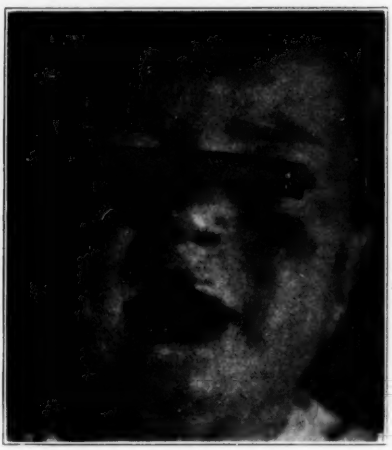

Fig. 2.—Case shown in Figure 1, after completion. The plastic operation was performed on the lip at the age of 9 months. The soft palate was closed at the age of 22 months.

Fig. 3.—Double cleft of hard and soft palate and lip with protrusion of premaxillary bone. The hard palate was closed at the age of 7 months.

Fig. 4.—Profile of patient in Figure 3, showing extensive protrusion of the premaxillary bone.

operation on the lip and nostril (Figs. 2 and 5), performed at from 3 to 6 months of age. I believe that it is best to wait until the child is at least 3 months old to allow the vermilion lines of the skin to be well developed, for the least discrepancy in placing the skin-mucus lines of the lip will show up very badly when the child is several years old.

The third, or final, operation is the

closure of the soft palate, or all of that part remaining open, posterior to the alveolar ridge, which was closed at the first operation. This operation consists of freeing the palate tissue from the bone on either side of the cleft, back to the gingivae, freshening the margins all the way back and including that part of the uvula that remains on either side. These free flaps are closed in the median line with horsehair, the mattress stitch being used. Two silver wires are placed in the soft palate well back from the suture line and are passed through lead plates, the ends being twisted together tightly enough to relieve the tension on the suture line. If the tension is too great on the suture line, it is necessary to make lateral relaxation incisions near the gingivae and extending around the tuberosity, to allow the tissue to be moved to the median line.

Fig. 5.—Case shown in Figures 3-4, after complete closure of palate and lip. The plastic operation on the lip was performed at the age of 1 year. The soft palate was closed at the age of 22 months.

PREOPERATIVE CARE

Much consideration should be given to the preoperative condition in these cases, especially in young babies. It is routine in my practice to place the babies immediately in the care of a competent pediatrician for complete examination, which includes a roentgenogram of the thymus, and an inquiry into the history of any recent exposure to contagious disease. If the roentgenogram shows an enlarged thymus, roentgen therapy is employed until the thymus becomes normal. The younger babies have to be at least holding their own in weight, or gaining. It is routine in all cases to have the tonsils removed before the final operation or closure of the soft palate. I never operate in the face

Fig. 6.—Complete right side cleft of hard and soft palate and lip. The lip was operated on in early infancy without closure of the hard palate. The alveolar ridge is intact, but there is no union. The nose is deflected to the left side and the palate is open.

of an adverse recommendation of the pediatrician.

For the purpose of drying up excessive bronchial secretions, a preliminary hypodermic injection of atropine is given shortly before operating. The dose ranges from one one-thousandth grain in children under 2 years of age, to one one-hundred-fiftieth grain after 12 years of age. In patients over 12 years of age, from one-eighth to one-quarter grain of morphine sulphate is added for the usual sedative effect.

Fig. 7.—Condition of palate in Figure 6. There is an opening above the alveolar ridge. (Looking down through the cleft palate.)

Fig. 8.—Patient shown in Figure 6 after completion of case. It was necessary to make a greenstick break in the maxilla on the left side to get complete closure of the alveolar ridge. The nose was brought into proper alinement. The lip and nostril were again operated on and the palate was closed.

After the patient is under the anesthetic, the field is cleansed as thoroughly as possible with alcohol sponges.

During the past few years, I have had occasion to close the soft palate in at least six cases in which there were originally complete clefts of the hard and soft palate and lip. The lip was closed over the cleft of the alveolar ridge without first closing the ridge (Fig. 6). It is true that the pressure of the lip brought the points of the cleft ridge together, but without union. In all of these cases, there was a hole above the contact points of the ridge under the vestibule of the lip, which led through to the cleft in the hard palate (Fig. 7). I have never been able to close such an opening and have it completely fill in. Even though the points of the alveolar ridge are intact, there is no union. To assure union, it is necessary to make a greenstick break, pare away enough tissue from each point of the ridge to get a fresh surface and, with circumferential wiring, bring the parts into close contact. The wire is left in place about six weeks, until union takes place. In all of these cases, the nostril

on the cleft side had to be reconstructed because the ala was flat instead of having a normal groove separating it from the cheek. In some of the cases, the lips were thin and stretched, showing very little of the vermilion surface. It is impossible to relieve this form of thin stretched lip. Had the alveolar ridge been closed and union obtained before closing the lip, the nose would have been in its proper position in the midline of the face, with a good foundation obtained upon which to construct the lip and the ala of the nose reformed to match that of the opposite side. Also, the cavity under the vestibule of the lip looking down into the cleft of the palate would have been entirely eliminated, one and probably two extra operations being obviated.

Recently, Dr. Logan, of Chicago, made a check of alveolar ridge cases that were closed by the Brophy wire pressure method as compared to cases treated by first closing the lip and depending on the pressure to close the alveolar ridge. He found that there were more cases of irregularity of the teeth and underdevelopment of the maxilla in those cases which had never been wired.

Fig. 9.—Complete left side cleft of lip, alveolar ridge and palate in boy, aged 13.

Fig. 10.—Case shown in Figure 9, after complete closure of alveolar ridge, palate and lip. The alveolar ridge was closed by chiseling through the outer cortex of the maxilla between the cuspid and first bicuspid on the right side and making a greenstick fracture to make contact with the points of the alveolar ridge at the cleft line.

In closing the alveolar ridge by the wire pressure method, it is absolutely necessary that the wires be placed high above the alveolar ridge through the

maxillary bones. Otherwise, we invite failure.

In the adult cases, if the alveolar ridge is cleft in the anterior part (Fig. 9), it is necessary to make a greenstick break just posterior to the cuspid on the long side of the cleft in order to approximate the cleft points of the ridge. After reflecting upward a three-cornered mucoperiosteal flap in the region of the cuspid, with a thin chisel, the operator makes an incision through the outer cortex of the bone between the cuspid and the first bicuspid extending upward from the gingival margin and curving anteriorly into the ala of the nose. With heavy pressure, this anterior portion is broken to make contact with the point of the ridge on the opposite side. The points of contact are freshened and circumferential wiring is used to hold the points of the ridge in contact. The mucoperiosteal flap can be sutured back in place, thus covering the incision in the buccal surface of the bone. This wiring, as in the hard palate operation on infants, should remain in place six weeks (Fig. 10).

POSTOPERATIVE CARE

In the lip cases, I use the Logan bow, held in place by adhesive straps. This keeps the incision exposed to the air and allows access to it for keeping it clean. As many times as necessary throughout the day, the incision is cleansed with applicators saturated in boric solution. Tincture of metaphen is applied once daily. In palate cases, the area is flushed four times daily with boric solution in an ear bulb syringe. Tincture of metaphen is applied to the incision with an applicator once daily. Four or five drops of 20 per cent argyrol (solution of mild silver protein) in each nostril is used once daily.

Occasionally, repaired cleft palates seem to be foreshortened, and these short palates interfere with speech. There are two methods by which this condition can, to some extent, be relieved. One is the Dorrence push-back method, which consists of freeing all of the soft tissue from the hard palate and pushing it back to relieve the shortness of the soft palate. The denuded space on the anterior part of the hard palate is allowed to fill in by granulation. The other method, known as the Brophy method, consists of freshening and suturing the margins of the posterior pillars on either side of the throat, back to what would be the normal posterior border of the soft palate. Just posterior to the last suture, the muscle on either side is severed about two-thirds of the way through, which relieves the tension and makes a flap that acts as a palate. This operation is much more simple.

RESULTS

Since these operations are not emergencies, there is no reason for taking undue risks. By following that policy and having every patient in the best possible condition before operating, I have been able to keep the mortality rate down to a minimum. In 2,300 operations, there have been three deaths.

CATAPHORETIC VELOCITY AND LOCALIZATION OF STREPTOCOCCI ISOLATED FROM INFECTED TEETH OF PERSONS HAVING SYSTEMIC DISEASE*

By EDWARD C. ROSENOW, M.D., Rochester, Minn.

DESPITE the voluminous literature indicating the importance, as sources of disease in remote structures, of mild, localized and often symptomless infections, such as those that are commonly present in the tonsils, teeth, prostate gland and uterine cervix, there is need for further study of the problem, particularly from the dental standpoint. The proper clinical application of the established truths, while seemingly simple, is often most difficult, calling for the combined judgment of physician, dentist and specialist. In the matter of operative procedure in dealing with foci, especially removal of infected teeth, much still needs to be learned.

The importance of pulpless, roentgenographically positive teeth is now generally recognized, but that of roentgenographically negative teeth as sources of infection in remote tissues is still unappreciated by members of both the medical and the dental profession. Intensive application of the principles involved in focal infection and elective localization have unfortunately sometimes led to insufficient consideration of other important factors in the pathogenesis, diagnosis and treatment of disease. Infected tonsils and teeth are still removed for the cure of conditions in which there is no possibility of causal relationship, and, inadvertently or otherwise, they are allowed to remain indefinitely in cases in which disease unquestionably, or with a high degree of probability, is attributable to or is made worse by localized infection harbored in them or in other similar structures.

Many clinicians still regard recurring symptoms of acute infection in these structures as prerequisites of a possible source of systemic disease. They seem not sufficiently aware of the fact that the streptococcus isolated from symptomless foci, and with which respective diseases have been reproduced, usually has low general virulence. Exacerbations following attempts at removal of certain foci of infection (especially infected teeth) for the relief of systemic conditions are still too often considered as indicating that the idea is wrong instead of as proof that the responsible focus has been found, and that the methods employed were inadequate.

Too much is often expected from the removal of foci, especially in far advanced chronic conditions. Although a focus of infection which for mechanical reasons cannot heal, or drain to the surface, makes for a prolonged conflict between host and parasite, resulting often in disease in remote structures, as indicated

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clinically[1] and as proved experimentally,[2] there is a general lack of appreciation of the importance of this basic fact. Moreover, this forced relationship is generally considered in too mechanical a sense. The bacteria and their toxic products absorbed from a focus of infection must overcome the same resistance of the host as those absorbed from regions other than foci in a grossly mechanical sense and which, although it is less likely, may also result in systemic disease. It has been shown conclusively that pulpless teeth,[3] whether roentgenographically positive or negative, of persons who are ill with systemic disease are nearly always infected; whereas normal, vital teeth are nearly always sterile.

The experiments on dogs in which elective localization and specific disease, and, concomitantly, increased susceptibility to intercurrent infections, followed devitalization and infection of teeth leave no doubt of the basic fact that infected teeth may be a source of systemic disease and of general lowered resistance.[4] Nephrolithiasis, alkaline phosphatic cystitis, ulcer of the stomach, ulcerative colitis, heart disease and chorea-like movements have been reproduced consistently by removing the pulps of the teeth of dogs and infecting the pulp chambers with streptococci isolated from teeth or other organs of patients suffer-

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2. Billings, Frank: Footnote 1. Cook, T. J.: Focal Infection of Teeth and Elective Localization in Experimental Production of Ulcerative Colitis, J.A.D.A., 18:2290-2301 (Dec.) 1931. Horing, F. O., and Arjona, E.: Ueber Elective Lokalization von Bakterien, Ztschr. f. d. ges. exper. Med., 91:549-561 (July) 1933. Jones, N. W., and Newson, S. J.: Experimentally Produced Focal (Dental) Infection in Relation to Cardiac Structures, Arch. Path., 13:392-414 (March) 1932. Rosenow, E. C.: Experimental Observations on Etiology of Chorea, Am. J. Dis. Child., 26:223-241 (Sept.) 1923. Rosenow, E. C., and Meisser, J. G.: Elective Localization of Bacteria Following Various Methods of Inoculation and Production of Nephritis by Devitalization and Infection of Teeth in Dogs, J. Lab. & Clin. Med., 7:707-722 (Sept.) 1922; Production of Urinary Calculi by Devitalization and Infection of Teeth in Dogs with Streptococci from Cases of Nephrolithiasis, Arch. Int. Med., 31:807-829 (June) 1923.

3. Austin, L. T., and Cook, T. J.: Bacteriologic Study of Normal Vital Teeth, J.A.D.A., 16:894-896 (May) 1929. Cook, T. J.: Dental Granuloma Ten Years After Apicoectomy, D. Cosmos, 71:1065-1067 (Nov.) 1929; Dental Foci of Infection: Clinical and Experimental Studies of Relation of Foci to Systemic Disease, D. Cosmos, 71:711-718 (July) 1929; Footnote 2, second reference. Cramer, H. C., and Reith, A. F.: Quantitative Bacteriologic Study of Pulpless Teeth Correlated with Dental Roentgenograms, J.A.D.A., 19:976-982 (June) 1932. Haden, R. L.: Dental Infection and Systemic Disease, Philadelphia: Lea & Febiger, 1928. Rhoads, P. S., and Dick, G. F.: Roentgenographically Negative Pulpless Teeth as Foci of Infection; Results of Quantitative Cultures, J.A.D.A., 19:1884-1893 (Nov.) 1932.

4. Rosenow, E. C.: Focal Infection and Elective Localization, Internat. Clin., 2:29-64 (June) 1930; Studies on Focal Infection, Elective Localization and Cataphoretic Velocity of Streptococci, D. Cosmos, 76:721-744 (July) 1934.

ing from these respective diseases. Housing conditions and a diet adequate to keep the control dogs well proved inadequate for health in dogs that were made to harbor the type of dental infection found so commonly among patients suffering from the diseases named, or other diseases. The dog's teeth from which the pulp had been removed and the pulp chamber infected became discolored, but remained firmly and painlessly in place. In most instances, a varying degree of periapical rarefaction and deposit of granulation tissue developed from which the streptococcus that had retained elective localizing power was consistently isolated and demonstrated microscopically.

While localization and the production of lesions in remote structures, aside from predisposing factors such as trauma, have been shown to be attributable largely to inherent or acquired, highly labile, specific properties of the bacteria and their toxins found in foci, there is still a marked lack of knowledge as to how the bacteria, usually streptococci, maintain or acquire their respective specificity, and to what properties peculiar localizing power is attributable. The fact that bacteria and their toxic products do localize and produce lesions specifically in certain structures is no more remarkable than the specific pharmacologic action of certain drugs, and the basic reasons are no doubt similar.

In a recent paper,[5] I have reported a general summary of experimental studies on focal infection and elective localization, and that of recent corroborative work by others,[6] in which references to the more important publications are given. In this paper, I wish to report the results of studies made by new methods on the specificity of streptococci as isolated from infected teeth of patients suffering from systemic disease, and, as far as possible, to indicate the epidemiologic and etiologic importance of the newly ascertained facts.

5. Rosenow, E. C.: Footnote 4, second reference.

6. Grumbach, A.: Die Lehre von der fokalen Infektion, Ergebn. d. Hyg. Bak. Immunitsf. u. exper. Therap., 15:442-609, 1934.

METHODS OF STUDY

The material for study was obtained chiefly from patients in The Mayo Clinic and the Rochester State Hospital. The diagnoses were made by the attending physicians. The teeth were extracted by members of the Section on Dental Surgery, aseptic precautions being taken, and nasopharyngeal swabbings were made by me. The field of operation, after block anesthesia, with procaine and epinephrine, was isolated with sterile cotton and gauze. The mucous membrane was thoroughly disinfected with tincture of iodine and alcohol. A control culture, in dextrose-brain broth, of the material obtained by swabbing the disinfected area was made just before the extracting forceps were applied. The tooth was then extracted and the apical third, usually of a tooth with a single root, with or without the adherent granuloma, was immediately severed with bone-cutting forceps and placed in 2 c.c. of a sterile gelatine (0.2 per cent) Locke's solution containing a small amount of quartz sand. This was then taken to the laboratory where, after thorough shaking, cultures were made as follows:

Three drops of the washings were spread over the surface of a blood-agar plate. About 0.5 c.c. was inoculated into melted and cooled (40 C.) soft dextrose (0.2 per cent)-brain-agar (0.5 per cent), contained in tall tubes, and 1 c.c. was inoculated chiefly around the pieces of brain at the bottom of a tall, warmed (35 C.) tube of dextrose (0.2 per cent)-

brain broth. The remaining gelatine Locke's solution containing the root tip was then transferred to an additional tube of warmed dextrose-brain broth. In special instances, the root tip was wrapped in sterile gauze, crushed in the jaws of a vise, and the pieces placed in dextrose-brain broth, or dextrose-brain broth to which 10 per cent sterile ascitic fluid had been added. One of the tubes of dextrose-brain broth was routinely heated to the boiling point to reduce the free oxygen, and was then cooled just before the inoculum was added.

The nasopharynx was swabbed, without touching the tongue, with cotton-wrapped aluminum wire bent at a suitable angle. The swab was immediately placed in 2 c.c. of Locke's solution containing gelatine (0.2 per cent) and the material contained on the cotton was washed off by vigorous agitation. Cultures of the washings were made on blood-agar and, routinely, into previously warmed dextrose-brain broth. Freshly prepared dextrose-brain broth, or that not older than a week or 10 days, was mainly used throughout the study. In general, the fresher the broth, the better the results. Cultures were usually made in the afternoon and the tubes incubated at 35 C., until the following morning, or longer if abundant growth had not occurred. Plate cultures and smears were made the following morning of all positive dextrose-brain broth cultures. Only those which showed pure or nearly pure cultures of streptococci in smears, the control cultures for which were negative, were used for cataphoretic studies.

The dextrose-brain broth is prepared by dissolving 8 gm. of dehydrated "bacto" broth in 1,000 c.c. of distilled water, and adding 8 gm. of sodium chloride, 2 gm. of chemically pure dextrose, 1.5 c.c. of normal sodium hydroxide, and, after cooling, 1.0 c.c. of Andrade's indicator. It is also prepared from beef infusion, 0.2 per cent dextrose being added in the usual way, with titration to p_H 7.4. Several bacteriologic peptones on the market have been used with about equally good results. The dextrose-brain-agar is prepared from the broth by adding 4 or 5 gm. of powdered agar to each liter, just a sufficient quantity to cause it to set. The mediums are placed in tubes measuring 20 by 1.5 cm. To each tube are added three pieces of calf or beef brain, each about 1 c.c. and two or three pieces of calcium carbonate, in the form of crushed marble, to insure correct reaction. The column in each tube, after the brain and marble are added, is about 12 cm. high. The mediums are sterilized for twenty minutes in the autoclave at a pressure of 20 pounds. Growth in these mediums, which are kept at from 35 to 37 C., usually occurs within twenty-four hours, and, in most instances, especially when the cultures are from pulpless teeth, it begins at the bottom of the tube and forces its way to the top as oxygen is consumed. This usually occurs within twenty-four hours in the dextrose-brain broth; whereas, in dextrose-brain-agar, growth to the top, or more often to within 1 cm. of the top, frequently takes from two to three days. Negative cultures are observed daily for a week or ten days before they are discarded. Colonies in the agar may be exceedingly small; or they may develop only around the pieces of brain at the bottom and may be easily overlooked; or they may be so numerous as to give the appearance of a negative culture.

As a routine for cataphoretic studies, the top 2 c.c. of the primary 16 to 24 hour culture in dextrose-brain broth, and, in some instances, of rapidly repeated subcultures or of single colony cultures from dextrose-brain-agar, in this medium as isolated from the tooth washing, was

poured into scrupulously clean test tubes of the usual size. This was then centrifuged until the broth had just cleared, and the supernatant fluid was poured off and thoroughly drained by leaving the tubes inverted on sterile filter paper, or a towel, for at least five minutes. About 2 c.c. of distilled water was added and the sedimented bacteria thoroughly mixed with the water. Then, about 10 c.c. of distilled water was added from a siphon and the contents poured into the Northrop-Kunitz-Mudd cataphoresis apparatus. The age of cultures, the duration of centrifugation, the amount of water added to the suspension, the time after making the suspension in distilled water and the readings were made as nearly comparable as possible throughout the study. The readings were made in the same apparatus, which was properly cleaned and checked by known suspensions, usually by the same person without knowledge of the source of the cultures.

In the lower, neutral layer of the cell, the velocity of twenty of the suspended streptococci was determined, a stop watch being employed to measure the time required for the organisms to traverse the unit distance of 48.1 microns, or two squares in the field. The direct current of the zinc sulphate, nonpolarizable electrodes (122 volts) and the temperature (26 C.) varied little throughout the study. The effective voltage between the platinum electrodes (which were 3.79 cm. apart) by actual measurement in a large number of control preparations of suspensions of streptococci from different diseases, determined immediately before and after taking the readings, was found to be about 26.5; hence, the velocity in microns per second, per volt per centimeter equals: $\frac{48.1}{\text{time} \times \frac{\text{voltage}}{\text{distance between electrodes.}}}$ For example, neurotropic streptococci traversed the unit distance of 48.1 microns in four seconds, when an effective potential difference of 26.5 volts is measured between the electrodes separated by a distance of 3.79 cm. Hence, the mobility of these organisms in microns per second, volts per centimeter equals $\frac{\frac{48.1}{26.5}}{4 \times 3.79}$ =1.72 microns per second, volt per centimeter.

RESULTS

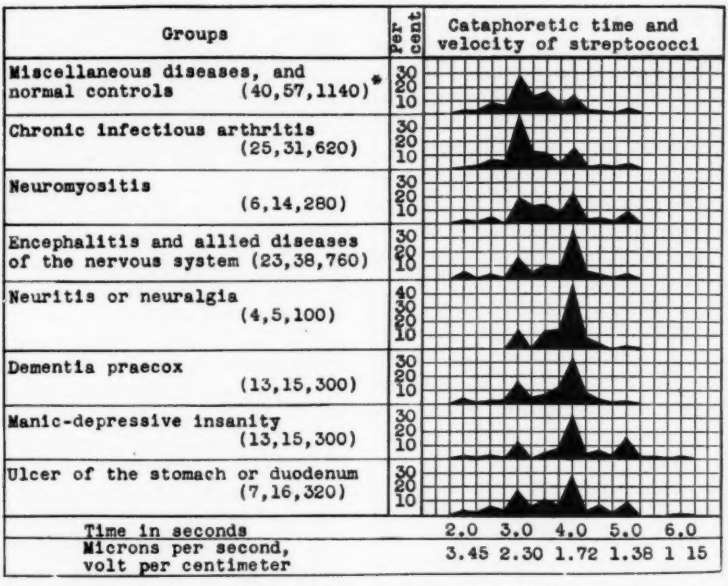
A detailed analysis of the clinical results of removal of foci in these cases, together with a larger series, is contemplated. Only a general statement will be given here. Improvement following removal of foci, in this series of cases of infected teeth, from which the apparently causative streptococci were isolated as in previous studies, occurred repeatedly,[4] and so promptly in some cases, especially in those in which the disease was of short duration, as to leave little doubt that improvement was attributable to this fact. In this study, as in previous studies, it has happened repeatedly that removal of infected tonsils was without benefit until one or more infected teeth also were removed. In some cases, improvement occurred so gradually that it was impossible to know whether it was the result of removal of infected teeth, of other therapeutic measures also employed or of coincidental causes. In some cases, the course of the disease was not perceptibly modified.

The results of studies of the cultures from teeth have in part been reported elsewhere, Suffice it to say here that, in the great majority of instances, the control culture in dextrose-brain broth from the swabbing made after sterilizing the field and just before applying the forceps remained sterile, and cultures in dextrose-brain broth and dextrose-brain-agar from

washings of the root tip and from the root tip itself nearly always yielded streptococci, chiefly in pure or nearly pure culture. Blood-agar platings of the cultures in dextrose-brain broth nearly always revealed pure or nearly pure cultures of green-producing, indifferent or slightly hemolytic, but never typically hemolytic, colonies of streptococci.

Goodly numbers of staphylococcus-like colonies were only rarely encountered. colonies that grew in shake cultures of the washings was large, a hundred or more in most instances. The blood-agar plate almost never showed growth when the number of colonies that grew in the shake culture in dextrose-brain-agar was relatively small.

Streptococci having characteristic cataphoretic velocities have also been isolated from the enamel organ of unerupted teeth, and even from the trephined, apical



*The figures in parenthesis and those inserted in the graphs indicate, respectively, the number of strains, cultures and streptococci timed in each group studied.

Fig. 1.—Cataphoretic time and velocity of streptococci isolated from infected teeth of persons who have systemic disease.

The blood-agar plate inoculated with the washings remained sterile in about half the cultures, and showed relatively few colonies (always fewer than the number of colonies in shake cultures of dextrose-brain-agar) of green-producing streptococci in the remainder. The number of ends of pulpless teeth which had previously shown rarefaction but in which there was filling in of bone after antiseptic treatment.[5]

The study of elective localization in animals, while justified by the great significance of the findings, is peculiarly ex-

acting in its technical requirements, chiefly because of instability of the property on which elective localization depends; is time-consuming and expensive, and has other disadvantages. I have, therefore, sought out new methods that might yield similarly important information. L. B. Jensen and I, at his suggestion, studied cataphoretically streptococci that had different elective localizing power.[7] We found that (1) a high percentage of streptococci isolated from foci of infection in cases in which patients suffered from encephalitis and allied diseases of the nervous system had a "neurotropic" cataphoretic time and velocity of chiefly 3.45 and 1.72 microns per second, volt per centimeter, and that a high percentage of streptococci similarly isolated in cases of arthritis had an "arthrotropic" cataphoretic time and velocity of 2.30 microns per second, volt per centimeter; (2) there was definite correlation between elective localizing power and the electrocataphoretic velocities exhibited by the respective streptococci, and (3) dextrose-brain broth, which has been found so useful in a study of the bacteriology of foci and remote tissues, and in preserving the property on which elective localization depends, also maintained the characteristic cataphoretic velocity of streptococci. With Drs. Pratt and Sheard[8] of the Division of Biophysics, it was found that if the charge or cataphoretic velocity of the streptococci was changed artificially by exposure to the high frequency field, short-wave length electrical energy, there occurred concomitantly that which I interpreted to be a change in localizing power. Thus, streptococci isolated in cases of chronic infectious arthritis had marked affinity for the joints of animals which had received injections and had a markedly "arthrotropic" cataphoretic velocity[9]; that is, a high percentage of them had a velocity of 2.3 microns per second, volt per centimeter. Streptococci isolated similarly in cases of chronic encephalitis had little or no affinity for joints, but had a marked affinity for the brains of animals that had received injections, and a markedly "neurotropic" cataphoretic velocity[10]; that is, a high percentage of them had a velocity of 3.45 or 1.72 microns per second, volt per centimeter. When the cataphoretic velocity of "arthrotropic" streptococci isolated in cases of arthritis was changed to a "neurotropic" cataphoretic velocity by proper dosage of short-wave length electrical energy, they lost what I interpret as affinity for joints and concomitantly acquired affinity for the brain, and when the "neurotropic" cataphoretic velocity of the streptococci isolated in cases of encephalitis was changed to an "arthrotropic" cataphoretic velocity, they lost affinity for the brain and acquired affinity for joints.

In Figure 1, the results of cataphoretic studies of streptococci isolated from the teeth of persons suffering from different diseases are given graphically. It will be noted that the distribution curves of cata-

7. Rosenow, E. C., and Jensen, L. B.: Elective Localization and Cataphoretic Potential of Streptococci, Proc. Soc. Exper. Biol. & Med., 27:442-444 (Feb.) 1930; Cataphoretic Mobility and Elective Localization of Arthritic and Neurotropic Streptococci, Proc. Staff Meetings, Mayo Clinic., 5:49-51 (Feb. 19) 1930; Cataphoretic Velocity of Streptococci Isolated in Cases of Encephalitis and of Other Diseases of Nervous System, J. Infect. Dis., 52:167-184 (March-April) 1933.

8. Pratt, C. B., et al.: Symposium on Cataphoresis and Localization of Streptococci; High Frequency Field as Agent in Changing Cataphoretic Velocity and Localization of Streptococci, Proc. Staff Meetings, Mayo Clinic, 8:496-504 (Aug. 16) 1933.

9. Rosenow, E. C.: Cataphoretic Velocity of Streptococci as Isolated in Studies of Arthritis, Arch. Int. Med., 51:327-345 (March) 1933.

10. Footnote 7, third reference.

phoretic time and velocity of the streptococci are very similar and markedly neurotropic for those organisms isolated from persons who had symptoms referable to the nervous system, and that these are strikingly different from the distribution curves of the streptococci isolated from persons who were suffering from chronic infectious arthritis, which are markedly arthrotropic. The distribution curve of cataphoretic velocity of streptococci isolated from the teeth of persons who had miscellaneous diseases, which tween that markedly neurotropic, as for organisms isolated from persons who had diseases of the nervous system, and that markedly arthrotropic, as for organisms isolated from persons who had chronic infectious arthritis. The distribution curve of cataphoretic velocity of the streptococci isolated from persons with ulcer is moderately neurotropic, which is in accord with the neurogenic theory of ulcer and with the fact that the site of disease, the mucous membrane of the stomach or duodenum is embryologically of ecto-

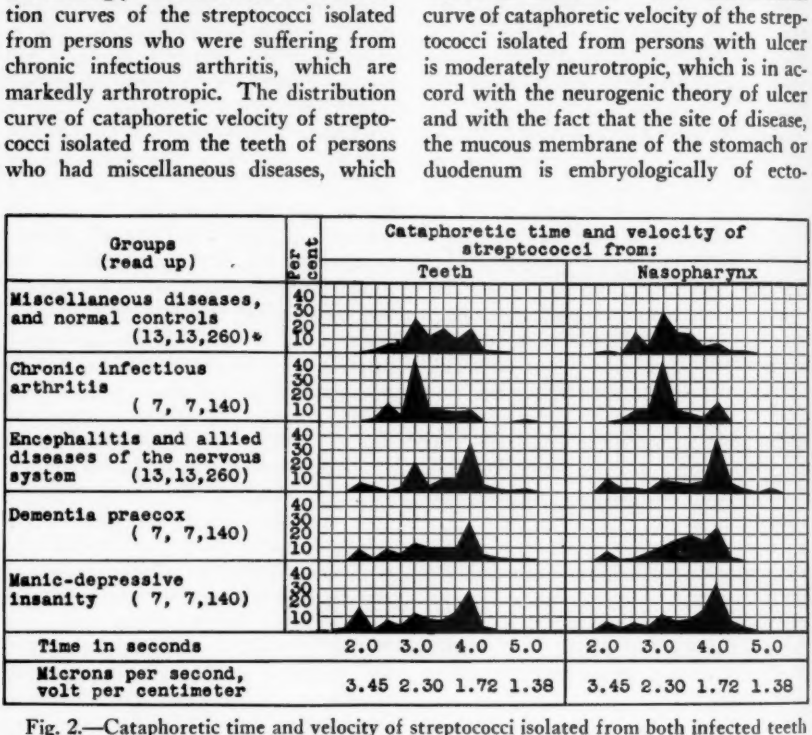


Fig. 2.—Cataphoretic time and velocity of streptococci isolated from both infected teeth and nasopharynges of persons who have systemic disease.

clearly were not attributable to streptococci, and of normal controls, is similar to that for streptococci isolated from patients who had arthritis, except that the percentage of organisms in the "arthrotropic" column (2.30 microns per second, volt per centimeter) is not so high. The distribution curve of cataphoretic velocity of streptococci isolated from persons with neuromyositis is transitional, varying between that markedly neurotropic, as for organisms isolated from persons who had diseases of the nervous system, and that markedly arthrotropic, as for organisms isolated from persons who had chronic infectious arthritis. The distribution curve of cataphoretic velocity of the streptococci isolated from persons with ulcer is moderately neurotropic, which is in accord with the neurogenic theory of ulcer and with the fact that the site of disease, the mucous membrane of the stomach or duodenum is embryologically of ectodermal origin, as is the nervous system.

To check the reliability of the methods, the cataphoretic velocity of cultures of streptococci which grew from the tooth washing and from the root tip of the same tooth were determined simultaneously in twenty-one cases. Agreement in type of distribution of cataphoretic velocity was found in twenty cases and disagreement in only one. In forty-seven cases, which

are not included in Figure 1, the cataphoretic velocity of the streptococci isolated both from extracted pulpless teeth and from the nasopharynx was determined. Agreement in type of distribution of cataphoretic velocity occurred in forty-four cases and disagreement in three. The average distribution curves for streptococci isolated from teeth and nasopharynx, respectively, of the different groups of diseases are given in Figure 2. The similarity between the cataphoretic velocities of streptococci isolated from the teeth and from the nasopharynx in each group is striking, and each of these curves resembles closely the curve of the respective groups in Figure 1.

Shifts in the distribution curves of cataphoretic velocity of streptococci isolated from nasopharynges of well persons and of those ill with chronic systemic disease, according to season, and shifts toward that distribution curve characteristic of streptococci of epidemic respiratory infections, especially influenza, have been shown to occur with striking frequency.[11] In a few instances, the slow toxigenic type of distribution curve characteristic of the streptococci of influenza has been noted for streptococci isolated during epidemics of influenza from the infected teeth of persons who did not have influenza, and also during convalescence from influenza.[5]

The cultures from teeth in the groups studied (Fig. 1) were obtained over a period of four years. The cases in which cultures from teeth were made for each group of diseases were then divided according to whether the cultures were made during the six months from January to June, when respiratory infections were common, such as influenza associated with streptococci having a markedly different distribution curve from streptococci isolated from normal persons, or during the six months from July to December, when respiratory infections associated with streptococci having distribution curves markedly different from the normal occurred rarely. A decidedly slower, more "influenzal" type of cataphoretic velocity of the streptococci was obtained in each of the groups of diseases during the six months from January to June, when influenzal respiratory infections were most prevalent, than that of streptococci isolated in the period from July to December (Fig. 1). Aside from this somewhat slower average velocity during the winter and spring months and the arthrotropic type of cataphoretic velocity of streptococci isolated during the period from July to December from persons who had neuromyositis, the distribution curves are fairly characteristic of the diseases in each group.

The distribution curves of cataphoretic time and velocity of streptococci isolated from the nasopharynx of persons during acute attacks of nasopharyngitis (colds) or influenza, according to season, are included in Figure 3 to show that the distribution curves of cataphoretic velocity of streptococci isolated in cases of epidemic nasopharyngitis (the common cold), and of streptococci isolated from patients with epidemic influenza, are strikingly different. No decided change in the average distribution curve of cataphoretic velocity in a study such as this should be expected during epidemics of colds, because the cataphoretic velocity (2.79 and 1.97 microns per second, volt

11. Rosenow, E. C.: Seasonal Changes in Cataphoretic Velocity and Virulence of Streptococci as Isolated from Well Persons, from Persons Having Epidemic or Other Diseases and from Raw Milk, J. Infect. Dis., 53:1-12 (July-Aug.) 1933; Cataphoretic Time and Velocity of Streptococci and Pneumococci Studies on Organisms Isolated in Cases of Common Cold, Influenza, Bronchopneumonia and Lobar Pneumonia, J. Infect. Dis., 54:91-122 (Jan.-Feb.) 1934.

per centimeter) of streptococci isolated from persons who have colds is not sufficiently different from the average cataphoretic velocity of streptococci isolated from well persons and from persons who had the diseases studied.

During epidemics of influenza, there was found a definite shift in cataphoretic velocity of the streptococci isolated from well persons and from persons ill with some chronic disease toward that velocity common cold) and influenza, respectively (Fig. 3). These differences were not attributable to any difference in the average temperature at which measurements were made in each of the periods of six months. It was found that of the 191 cultures of streptococci that were timed, and which had been isolated from teeth, in twenty-four cultures organisms had a "cold" or "nasopharyngotropic" type of velocity and in twenty-two an "influenzal" or

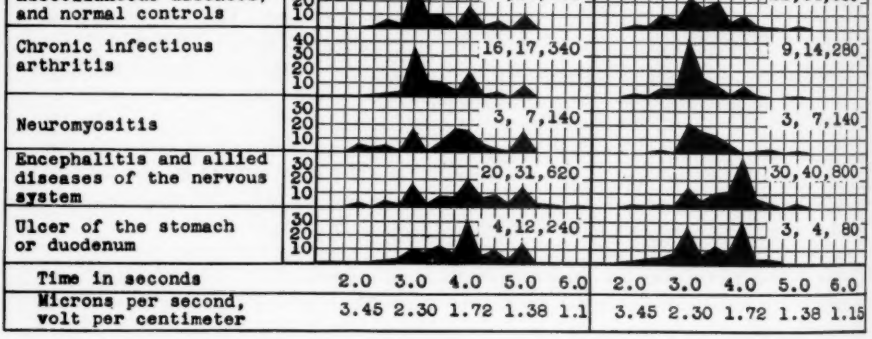


Fig. 3.—Seasonal variation in cataphoretic time and velocity of streptococci isolated from infected teeth of persons who have systemic disease.

characteristic of streptococci isolated from persons with influenza (1.72, 1.54 and 1.38 microns per second, volt per centimeter). The slower, more influenzal or "toxigenic" type of velocity shown during winter and spring by streptococci isolated from teeth in each of the groups studied was also noted of streptococci isolated from the nasopharynges of persons who had epidemic nasopharyngitis (the "bronchotropic" type of velocity. These had a markedly seasonal distribution, corresponding roughly to the seasonal distribution of the common cold and of influenza. Thus, of the twenty-four cultures, the organisms in which had a "cold" type of velocity, eighteen were obtained during autumn. One was obtained during winter, two were obtained during spring and three were obtained during

summer. Of twenty-two cultures consisting of organisms having an "influenzal" type of velocity, two were obtained during autumn, ten during winter and ten during spring.

In previous studies of chronic diseases[12] as in this new series of cases, specific slowing (charge-reducing) action of the serum of persons on the respective streptococci isolated from foci other than in teeth was noted. Similar specific action was found in this study of the serum of persons suffering from encephalitis, arthritis, hemiplegia and ulcer, on the respective streptococci isolated from the teeth. Decided slowing action of the serum on streptococci was noted consistently when organisms were isolated from the teeth of the respective patients and on stock strains of streptococci isolated from the nasopharynges or teeth of patients who had the same disease when the serum was in dilutions as high as 1:2,560. In contrast, slowing action of serum, in dilutions of 1:80 or 1:160, on streptococci ceased when tested on organisms which were isolated from persons who had diseases other than that from which the respective patient was suffering. Improvement following removal of teeth was especially noticeable in the cases in which the specific antibody content of the serum was high.

COMMENT AND CONCLUSIONS

In a study of cataphoresis of streptococci isolated from infected teeth of persons suffering from widely different systemic diseases, as in former studies, relief of symptoms occurred in some cases, including insanity (qualified in the next paragraph), following removal of teeth shown to be heavily infected, especially in cases in which the serum was found to be rich in specific antibodies. Streptococci having peculiar cataphoretic velocities were isolated from pulpless teeth quite regardless of whether such teeth had been roentgenographically positive or negative; regardless of what method of treatment was used to prevent or eradicate infection following removal, or regardless of spontaneous death, of the pulp.

The methods used leave no doubt that the streptococci isolated were from the apices of extracted pulpless teeth and were not the result of contamination from the mouth, at least in the great majority of cases. The high incidence of positive streptococcic cultures is attributable largely, it is believed, to the use of the dextrose-brain broth and dextrose-brain-agar, mediums which afford a gradient of oxygen tension and other conditions favorable to growth of highly sensitive, partial tension or anaerobic organisms, and which maintain for a time characteristic cataphoretic velocity. In this study of the cataphoretic velocity of streptococci isolated from teeth, it was found, as in the case of streptococci isolated from other sources, that while characteristic cataphoretic velocity was retained for a longer time in dextrose-brain broth and dextrose-brain-agar than in other mediums, especially if subcultures were made at frequent intervals, characteristic velocity, just as elective localizing power, usually disappeared on prolonged cultivation on artificial mediums. "Specific" strains, irrespective of the disease in which isolated, frequently acquired distribution curves of cataphoretic velocity like those characteristic of streptococci from well persons and from persons who are not ill from streptococcal infections at times when there are no epidemics.[13]

12. Footnote 9. Footnote 7, third reference.

13. Rosenow, E. C.: Cataphoresis as Control of Specificity of Streptococcal Vaccines. Influenzal Streptococcus Vaccine in Prevention and Treatment of Infections of Respiratory Tract, J. Immunol., 26:401-433 (May) 1934.

Streptococci isolated from pulpless teeth and nasopharynges had similar distribution curves of cataphoretic velocity characteristic of the disease from which the patient from whom they were isolated was suffering. It is not concluded from these results that manic depressive insanity and dementia praecox are caused by the streptococci isolated. The fact that streptococci in such diseases are cataphoretically like those isolated in encephalitis and other diseases of the nervous system is suggestive. This question is being studied further.

The fact that the type of distribution curve of cataphoretic velocity of streptococci isolated from well persons is similar to that of streptococci isolated from persons who have chronic infectious arthritis, except that the number of streptococci having "arthrotropic" cataphoretic velocity is not so high, is in accord with the common occurrence of symptoms referable to joints and frank arthritis of human beings, and with the fact that the incidence of lesions in joints of animals following intravenous injection of streptococci from seemingly well persons has been found in repeated studies to be relatively high,[14] although always less, in our studies, than the incidence of lesions in joints following injection of the streptococcus similarly isolated from persons who have arthritis.

The distribution curves of cataphoretic velocity of streptococci isolated from the teeth of persons who have widely different diseases, and from well persons, vary perceptibly according to season and during epidemics of respiratory infection. The distribution curves of cataphoretic velocity, although remaining fairly characteristic of the respective diseases and of the normal flora of well persons and of those not suffering from diseases attributable to streptococci during epidemics, become more or less like those characteristic of streptococci at hand in the prevailing epidemic disease, especially influenza. The results from a study of the cataphoresis of streptococci isolated from human subjects and the specific slowing (charge-reducing) action of the respective serums are corroborative of previous studies on elective localization and emphasize anew the importance of variability in streptococci and of localized infection, especially in pulpless teeth, as sources of systemic disease. The focus affords conditions favorable for abundant growth and for forced entrance of bacteria and their products, and the peculiar localizing power and other properties of the bacteria, inherent or acquired, of which cataphoretic velocity, or electrical charge, is expressive or a part, determine the site of systemic localization. The marked specificity of the causative streptococci, so clearly revealed by the new methods, and general clinical experience indicate that, while elimination of foci is of basic importance, other measures, such as active and passive immunization with specific vaccines and serums, are necessary to cope successfully with these and other diseases which are directly or indirectly attributable to streptococci.

14. Valentine, Eugenia, and Van Meter, Martha: Localization of Streptococci in Tissues of Rabbits, J. Infect. Dis., 47:56-82 (July) 1930.

IS OPERATIVE DENTISTRY FAILING?*

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IN the October *Scientific Monthly,* E. A. Hooton, professor of anthropology, Harvard University, begins his discussion of "The Biology of Primitive Human Societies" with these words:

It seems to me that many of the main trends of scientific study are peculiar—not to say perverse. In spite of this fact that science is of man, the direction of scientific endeavor seems to be mainly centrifugal, or away from man himself. I mean that the quantity of scientific interest in any phenomenon, or in any conglomeration of matter, seems to vary directly with its remoteness from man himself. Thus, there are scores, if not hundreds, of scientists, who are looking for new stars and investigating spiral nebulae, for every one who is studying anthropoid apes.

This so strikingly suggests the attitude of the majority in the dental profession that I could not resist the temptation to quote his words. The simile can be observed in any of our big dental conventions. The big crowds will be found in the room where methods for removing teeth and replacing them with bridges and plates are being shown. If a clinic is given on a simple method for saving teeth, there may be a baker's dozen present, but you will almost have to fight your way into a room where they are extracting them. The crowd and interest will vary directly with the remoteness from saving teeth.

I have always thought that the greatest concern of dentistry should be the saving of teeth. The founders of our profession believed in and practiced saving teeth. The present order seems to be reversed. Our great interest is in getting them out and false ones in. Ask a dental supply house and they will tell you of mounting sales in extracting instruments and porcelain teeth.

We talk much and do little regarding real prevention. Our greatest interest has centered in the artificial substitute. We may look through the whole field of scientific treatment for any part or organ of the human body, and its parallel cannot be found. Could you imagine such ruthless abandon by those who treat diseased or injured hands or feet? Could you imagine a child being brought into an orthopedic clinic with a small lesion on its foot, which, if neglected or improperly treated, would mean unquestionably the loss of the foot, and the surgeon being indifferent, feeling all the while that it is not so bad to lose a foot, for the substitute is so natural looking—so nearly like the real thing in function—made of a new aluminite material, so light, and never squeaks, never shows any corns to hurt or an ingrown toe-nail, never gets cold, and never needs a bath?

Also, could you imagine the scene in an eye clinic when a patient calls, suffering from an infected eye? "Where is the doctor?" the patient inquires. The nurse tells her he is in the "art department." "You know, the doctor is becoming very much interested in the artistic side of his work and is making all of

*Read before the Chicago Dental Society, Jan. 15, 1935.

his artificial eyes himself." "Yes, I understand," says the patient, "but I did not come here to get a glass eye. In fact, that is just what I do *not* want. Besides, I am in pain."

The nurse replies: "I will send one of the girls into the art department and get him. You know, when he gets to staining one of those beautiful eyes, he never knows when to stop. I wouldn't be surprised to see him quit treating eyes and specialize in the artificial replacements. Here are some he has just worked up. Aren't they beautiful? They look just like they could weep—you can almost see the very soul behind them. The doctor seems to put so much personality into them. If they have one eye left, he can put all the natural markings of the real one in the artificial. He let me go with him last night to hear a great lecture on this subject by a Dr. I. Pluckem. Since hearing him, I don't feel so sorry for a person who loses an eye. You know the Bible says, 'If thine eye offend thee, pluck it out.' I think we are coming more and more to that way of doing. The doctor is getting tired searching for foreign bodies and removing cataracts. Besides, some of the patients cannot see out of the eye after the cataract is out.

"You know, the doctor is correcting a lot of cross-eyes. He finds it much more profitable and much quicker to just pluck the crooked eye out. Of course, one must be careful and not take the straight eye out. He has not done that for a long time now. He has a technic for finding the crooked eye. He just stands straight in front of the patient and has him look straight ahead, and the eye that points away from him is the one to take out. He removes the crooked one and puts in a hand colored straight one. It never gets crooked like the one he takes out, and when the patient gets older, he never has cataracts or pink eye or anything like that. You know the remaining eye gets stronger after one is out, so, after all, it is not so bad."

In a more serious mood, let me ask: Why this wholesale slaughter of teeth? Of course, there will always be teeth requiring extraction; but what I am trying to get at is the fact that millions are sacrificed because operative dentistry has failed.

I shall try to look the problem squarely in the face. I am not going to invent alibis for the dentist, even though, in special cases, he might be entitled to some. I am going to use plain words. I am surfeited with this talk about the great progress our profession is making, on one hand, and the great number of my friends wearing false teeth, on the other. To tell the truth, I am, for the moment, more concerned in finding and filling small cavities than I am in finding the cause back of the caries. I am content to trust that work to others better qualified.

If I had no better service to offer my patients than what I might give through tooth brushing and diet, most of my patients, especially the adolescents, would not have enough natural teeth in ten years to chew a doughnut. Yet I am convinced, as thoroughly as any person in this room, that a deficient diet may be a factor in dental decay. Instruction regarding foods supposed to prevent dental caries is daily routine in my office. If there is a dentist in this room who talks brushes and brushing more than I, it is because he has more people to talk to and more teeth to brush. I endeavor to supplement this with something more definite, more positive. I believe in, and try to practice, prevention that actually prevents.

It is estimated about 95 per cent of decay begins on the proximal surface and in the occlusal surfaces, and use of the toothbrush will not prevent it in either place.

I am convinced that some people are in their native lands immune to dental decay for no other reason than the nature of their native foods. Supply them with our foods, and soon their teeth decay as do ours.

To live in our land and choose foods that will keep us free from dental decay, from childhood to maturity, is impractical, if not impossible.

Philosophize as we may, with our present knowledge, with our established food habits, we must look to good operative procedures as our surest and most effective means for caries control.

If fillings are placed during the early stage of the disease, and properly made, they are about the only means of prevention that really prevents. We have all seen fillings that were placed by good operators thirty or forty years ago still doing the work of saving the teeth. Can you think of any other dental service for which we can say so much? The pity is that these good fillings are so seldom seen. The reason is simple enough: there have never been a very large number of these operators, but there have been enough to establish the fact that such work can be done, and if it is followed with good after-care by the patient, practically a lifetime of service may be expected.

It was Oliver Cromwell who said, "Trust in God, boys, but keep your powder dry."

We may trust the toothbrush and diet, but, if we are wise, we will keep our operating instruments sharp.

Prophylactic treatments, good as they are, must be repeated every few months, if the patient is to be kept free from periodontoclasia. Eternal vigilance is the price of a healthy periodontium. Can the periodontist say: "I have removed the deposits from your teeth; you are cured; they will not re-form." Can he clean and polish a tooth cervix, and find it so cleaned and polished after ten or twenty years?

Operative dentistry is the very backbone of our professional service, and because the rank and file of dental operators are failing so miserably, I am making the bold statement that operative dentistry is failing—simply because such a large percentage of fillings are failing. They fall short of what the patient can justifiably expect.

I recognize the fact that teeth carrying the best fillings in the world may be lost through periodontoclasia. I recognize that the work of the periodontist is fully equal to good operative work. The periodontist cannot save a tooth the crown of which is being destroyed by caries. Neither can the operator save a tooth with fillings, when the periodontium is being destroyed by periodontoclasia.

That operative dentistry is failing because fillings are failing is not the whole story. Failure to recognize and properly treat periodontal lesions in their early stages constitutes an indictment equal, in some respects, to that of operative dentistry, but I prefer to leave that task to the periodontist.

We cannot charge to the dentist those cases in which the patient delays his visit until the cavity has encroached on the dental pulp or the crown is so weakened that fracture is probable; but we can charge to the dentist failure to find thousands of small cavities when opportunity is offered, that stage in caries when, and only when, successful fillings can be made.

Where shall we place the blame when the operator does not know, and does not care to know, the simple procedures for examining the tooth crown for beginning caries? Or when he does find them, he proceeds to cut such deep cavities as to

endanger pulp vitality? Again, where shall the blame be placed when he fails to remove all the carious dentin? Or he fails to use the rubber dam?—the most common fault, and the greatest single sin in operative work. Where, I ask, must that blame be placed?

We hear a great deal about the 80 per cent of people who have no dental care. Perhaps it is true, and we must admit that the situation is serious. I have no plan by which to reach these people. I am talking about the 20 per cent who are supposed to be relieved of their dental troubles. We know that some of the 20 per cent are well cared for. On the other hand, there are thousands who simply have their troubles postponed. Thousands have been to their dentists and are assured that all is well, when, as a matter of fact, they have untold numbers of undiscovered cavities—cavities that are sure to cause trouble and perhaps the loss of the teeth. Furthermore, hundreds of thousands of the fillings were placed over areas of decay, and over the decay a good coat of saliva, the most highly infective fluid of the body: hundreds of thousands of amalgam fillings, which never did completely fill the cavity, with leaks beginning the very day the fillings were placed.

Suppose 1,000 fillings and inlays, made three years ago, were carefully removed, what percentage would be found in A1 condition, showing no sign of leakage or failure? Let us say, 1,000 fillings, one each made by 1,000 operators: do you think 2 per cent would pass muster?

How many times when a patient has taken the chair with a mouth full of fillings made three, five or ten years ago, have you been compelled, much against your wishes, to tell him the truth? In fact, the truth is so bad that we hesitate for two or three sittings, and then gradually break the news. "Well, what is a person to do? I went to the best dentist I could find. He was highly recommended to me by one of his patients. They told me he was an expert and gave lectures and clinics." He probably was an expert in things other than saving teeth. He might be an expert with "the facebow" or in "the pyschology of salesmanship." His most boisterous lecture and the one which made his reputation was "Sell Yourself to Your Patient." In other words, he has been looking for "spiral nebulae" and was but little interested in the simple things in saving teeth. He hasn't had a piece of rubber dam in his office since he opened it and his burs are so dull he could just about bore a hole in an apple.

As an evidence of how much interest we have in operative dentistry, look at one of our American Dental Association meetings. The special groups get there early, a week or more before the big meeting starts: The "Prosthodontias," the "Exodontias," and all the other "Dontias," especially the "Out-ye-dontias" and the "In-ye-dontias," but no "Save-ye-dontias."

The loudest talk, with the biggest crowd in attendance, will be on the subject farthest from the real issue. Just announce "A new discovery for making a full upper and lower in thirty minutes, requiring but one appointment with the patient—'never have to touch 'em,' " and you would need three policemen at the door.

On the other hand, announce a clinic showing the application of the rubber dam and making a small gold foil or amalgam filling, and the section would be as quiet as a mausoleum.

One great difficulty with dentistry is the universal lack of definite knowledge of our operative work. Each man, working alone with no definite figures on his results, offers us few facts on which to

base conclusions. He sees his work with easily satisfied eyes and listens to exaggerated compliments from incompetent patients. We get the most magnified and undeserved compliments from patients, when the results are far from what we wish. We have dissatisfied patients, with unpaid accounts, when the results were as good as we ever had in our lives.

If a life insurance company had no better actuarial facts on which to base their policies than we have on the anticipated life of fillings, they would fail in a year.

It requires time to prove fillings. Twenty-five years is none too long.

With improved operating instruments and materials, we should see the best operative work ever produced, and we do occasionally see just that. We have operators doing as fine work as, or finer work than, at anytime in our history, but they are entirely too few in number. There has been an unprecedented advance in other lines of our work. Tell me why operative work has not kept pace. Is it because about 90 per cent are operators and they imagine that they are in competition with each other, and, to get their share, they think that they must cut their price, which naturally lowers the quality? Is it because operative procedures are hard work and a daily routine of hard work begets a callous attitude that the dentist becomes careless and fails to use the rubber dam?

The tooth crown is the most vulnerable tissue of the human organism. Bathed constantly in the most highly infective fluid of the body, bacteria ridden, with no natural defense, it is the prey of millions of acid-forming organisms.

The operator who enters this picture and operates in this quagmire of filth and fails to use the only means we have, the rubber dam, to clean the field and at least approximate some surgical cleanliness is a disgrace to his profession.

In the *Pacific Dental Gazette,* an article on this subject[1] lists forty-four reasons for using the rubber dam. I should like some one of the 80 or 90 per cent who do not use the dam to give me one, just one, good reason that he does not use it.

A dental supply house which has 230 names on its books states that of this number only forty-nine buy rubber dam, and the sales are diminishing year by year.

If I wanted to find a good operator in a locality of which I had no personal knowledge, I know of no surer way than to go to the supply house and ask for the man who buys the most rubber dam. I would prefer it over any "expert rating" or recommendation of physician or patient.

As previously stated, 80 per cent of the people are getting no dental care. Of the 20 per cent who do get care, four, or more, out of five are destined to fall into the hands of men who do not use the rubber dam. This, in a measure, explains why so few receive dependable service. This supports the contention that operative dentistry is failing.

The cry goes out to "educate" the people and get them "tooth conscious." Why not say: "Educate the profession so they may get dependable service when they do go to the dentist"?

The enormous number of people getting no care at all make a dark picture; but the miserable failures in the operative field among those having had attention constitute nothing less than a tragedy. Failure to find cavities at a time when they may be successfully filled, and failure in properly filling them when they are found. Much as we dislike to admit it, the average filling is little short of a camouflage—a covering over of the true condition—putting off the time when the

1. Prime, J. M.: Preventive Dentistry that Prevents, Pac. D. Gaz., 41:83 (Feb.) 1933.

tooth must be sacrificed. Isn't it about time we face the facts? Isn't it time we quit wailing to the public "come on into camp and we will cure your dental ills," until we prove our ability to do a better job?

Don't you think it is time to stop some of the talk about the four year preparatory course and give some attention to what the graduate does in his first four years of practice?

Carnegie units look impressive in a curriculum, but they are not very practical as a material with which to fill teeth. If I were choosing a dentist, I could think of a thousand things more necessary than Carnegie units.

You must not think by this that I do not believe in the advantages of a trained mind, unless, by training, the simple, common sense factors in saving teeth are lost sight of.

Cavities are hidden away between teeth and in a multiplicity of occlusal faults, deeper at the dentino-enamel junction. If a study club were organized in Chicago and devoted itself to the examination of the crowns of teeth, it would mean more to the youth of the city than all the clubs on public speaking, business and economics combined. Contemplate what it would mean to operative dentistry in Chicago if groups would dedicate themselves to the task of tooth crown examination by the most painstaking methods. In my teaching over the country, I find men appallingly deficient in this all-important knowledge.

By the same token, were clubs organized to study clamps and rubber dam application, it would be more humanitarian than so much attention to methods of getting teeth out and replacing them.

If, after these beginnings of decay were discovered, many more clubs were organized to study modified cavity preparation and filling with gold foil, it could mean more to our youth, during the next forty years, than all other dental activities combined. We would be striking at the very heart of dental failures. We would be practicing prevention that really prevents. We would be locking the barn door before the horse is stolen.

Caries, like cancer, must be discovered early and treated early, if it is to be cured. We all understand very well what occurs when cancer is neglected. We know equally well what happens when caries is neglected. We know eradication and cure follows, if precancerous lesions are properly treated. We know equally well that if incipient caries is properly treated, complete cure follows. Scar tissue will result from the cancer treatment. There is a permanent wound in the case of the carious lesion, but thorough treatment effects a complete cure in each instance.

This indictment is based upon the fact that dental operators do not institute thorough and complete treatment at the right time and in a manner to effect a permanent cure.

Our efforts to save teeth with fillings could be briefly presented as follows:

Active caries, treated with poorly made fillings during adolescence.

Failing fillings replaced with more fillings to fail, placed during the early twenties.

Extractions, crowns and bridges, made during the latter twenties.

More teeth lost and more bridges, made during the early thirties.

Lost teeth and "semi-floating" prostheses, in the early forties.

"Full-floating" prostheses, furnished near the half century mark.

You will grant that a major portion of this work could have been obviated if thorough operative procedures had been followed when the first fillings were

made. Our faithful servants for seventy-five years, gold foil and amalgam will, if properly handled, go a long way in obviating these dental measures. Now that we have the gold inlay to further enlarge our armamentarium, our excuse for failure becomes still more slender.

I was speaking before a dental meeting when I asked this question: "How many in this room believe a gold foil filling in its proper place, and properly made, is the best filling known to dentistry?" Almost every hand went up. Then I asked: "How many are making them?" About 2 per cent raised their hands.

Don't you think this subject has passed from a matter of opinion to a matter of fact? Don't you think we now know enough about all substitutes for foil that we may speak plainly without fear of offense? Don't you think frankness and strict honesty with ourselves are in order? If it is an established, and a generally known and admitted fact that gold foil is superior to all other materials in selected cavities, my sense of logic, at the risk of offense, forces me to say the operator who does not use it must humbly accept the mediocre as his station.

The office of a gold foil operator skilled in modern technic is more valuable to the youth of a community than a bank or a garage. It is difficult to estimate the far reaching influence on the health of a community when the teeth of its youth are filled in a manner to assure preservation over a long period of time.

I would not have you believe a filling is destined to last for twenty or thirty years simply because it is made of foil. That would be far from the truth. The poorest filling put in a tooth is not a silicious cement, poor as it is. Neither is it a poorly made amalgam filling or a bad fitting inlay. Is is a poorly made gold foil filling.

Peculiar, is it not, that it may easily be the best filling made or the poorest, depending entirely on the operator?

A statistician has worked out the startling fact that, in this country, 2,250,000 boys and girls reach the age of 16 every year. This reveals to us something of the magnitude of the demand for this type of service. That is near the age where the curve of caries reaches its height. Our records indicate these youngsters need from ten to thirty fillings each. It would require 1,125,000 working hours of the most painstaking, meticulous work to even examine them. It would require more than 35,000,000 working hours to do their work, if I may judge from my own records.

This group represents only a small part of the work needed by American youth.

When we look some of these problems squarely in the face, you may forgive me for what, at first thought, might appear to be unjustified enthusiasm or slightly exaggerated statements that operative dentistry is failing.

If these young people had the operative care which they need, dentistry would be more nearly meeting the challenge made by Charles E. Mayo a few years ago, when he said: "The next step in preventive medicine must be made by the dentist." When Dr. Mayo issued this challenge, both the medical and dental profession answered it by a campaign of ruthless tooth extraction. Nor has it abated yet.

Don't you think Dr. Mayo would concur in a campaign to save these teeth while they are vital and in health? Would not this be a saner answer to his challenge?

The well-being of American youth rises above any professional rights. A way must be found to serve them. Duty knocks at dentistry's door. If we will not or cannot meet this public demand,

a hand vested with more power than ours will rise in their defense.

The current *Nebraska Dental Journal* quotes Newton G. Thomas, of Chicago, in a well written article on "Organization" as saying: "Dentists confronted their tasks daily with depressing reservations. They knew fillings did not cure caries. Their best finished products mocked them. With every filling went the feeling 'What's the use?' "

This attitude, shared by so many dentists, may explain, to a degree, the lack of progress in this branch of our work. I most emphatically agree with Dr. Thomas when he says, "It is more important to know what caused the disease than what should be put in the cavity." True—but do we know? Let me say, Dr. Thomas, that fillings of the right kind, made at the right time, *do* cure caries, as far as those cavities are concerned. Furthermore, it is the *only* cure known.

The good fillings made twenty or more years ago do *not* "mock" those operators who made them. As I see them there, just as they looked the day that they were finished, instead of mocking, they sing the sweetest music known to our professional ears.

Proper diet may prevent caries, but it never did, and perhaps never will, cure caries. I shall keep on curing carious cavities by the only method I know, until something better is known. Heaven hasten the day. "What is the use?" A near-life-time of use!

I surmise that most surgeons would place the knowledge of cancer cause above cancer cure, but they will depend on the latter until the former is an established fact.

It is not strange that the public holds reservations and misgivings about the dentist's ability to save the teeth, when members of the profession will say "What is the use?" We cannot blame them for an attitude that we take ourselves. One of the biggest factors in keeping people away from the dental chair is just that lack of confidence.

A patient said to me, "Well, what's the use? My sister went to the best dentist we could find, and had her teeth filled, then later she had to have them all extracted. The dentist said her teeth were too soft. I think I shall wait and have mine all out." Because many dentists think this, and because a large percentage of the laity believe it, I say operative dentistry is failing.

Again, why has operative dentistry failed to keep pace with those branches which have made such spectacular advances? It is the most difficult by far of all our procedures, especially when the entire operation is in the mouth. It is a little peculiar that the public and the dental profession, as well as the medical profession, seem to entertain the idea that a dental filling is an easy task. All three should recognize the fact that good dental fillings, if they do the work designed, are among the most difficult mechanical procedures performed by man. They are much more difficult than the removal of an appendix; a fact the medical profession would do well to recognize. Only because of the greater hazard are surgeons able to get a fee ten to fifty times greater.

The cast gold inlay has advanced because a large part of the procedure is performed in the laboratory. The preparation of baked porcelain is likewise partly a laboratory job, which may account for some of the progress noted in it. This leaves three materials confined almost entirely to work at the chair, amalgam, silicious cements and gold foil. Amalgam and gold foil are dependable materials, and their failures are chargeable very largely to poor operative ability.

Silicious cement failures are due to both poor operative skill and unreliability of material. No operator, however skilful, can make dependable, lasting operations with a material inherently unreliable.

The more dependable the material, the greater the response to operative ability. It is a happy combination when operative ability and material dependability join hands.

However good the material, the operator is dreadfully handicapped if he fails to use the rubber dam. Failure to use the dam is perhaps the commonest cause of poor fillings. Second is the failure to remove all carious tissues; third, the failure to include, in cavity outline, all occlusal faults.

Application of the dam is a simple procedure, in most cases. We encounter conditions wherein it is impossible, perhaps about 1 per cent. The mistaken idea of its difficulty prevents many dentists from using it. They make a difficult job of it because they do not understand how to go about it. One mistake is to put too many teeth through the dam. For a single filling, from two to three teeth are ample. Good operators no longer ligate the teeth. It is as unnecessary as to strap your patient to the chair, and causes much more injury.

I once considered it necessary to invert or evert the edge of the dam. I rarely go to that trouble any more. I push the teeth through the holes, pass a ligature to carry it past the contacts, dry the teeth with warm air and my difficulties are over.

Leaving carious tissue under fillings is as unpardonable as it is common. How much recurrent caries there is, how many fillings are lost and how many pulps die as a result, is incalculable. To what extent organisms may, in this manner, enter the living pulp, and through it infect the blood stream, is likewise undeterminable. Carious material must be removed entirely, unless, by so doing, we endanger the pulp, in which event it must be sterilized with silver nitrate. Have you made any cultures from the cement under failing inlays?

I know of but two conditions by which we may detect decay in a cavity wall: 1. Resistance to instrumentation. 2. Discoloration. We may be deceived in both of these if we fail to use the rubber dam and dry the tooth.

We must not overlook the fact that we are constantly dealing macroscopically with a microscopic problem. Did you ever see a microbe, except through a microscope? Did you ever seen an enamel rod? Did you ever see a dental tubule? Yet we deal with these in every cavity that we prepare. Truth is, we are blind to the essential elements from the beginning cavity to the finished filling. We cannot depend on our poor vision. We may greatly assist it by using ammoniacal silver nitrate, which not only sterilizes the infected tissue, but also definitely discloses it to our view. Silver nitrate solution should never be used in pits and fissures, except as a disclosing agent. It is not safe to try to immunize them with it. A sufficient amount cannot be gotten through the fissure to immunize the deep caries usually found at the dentino-enamel junction.

Failure to follow out fissure faults is a major cause for filling failure. Here, again, we have a problem in which our vision fails us. Unaided, we will, in many cases, fail to follow out the fault to its extremity. Here, as stated above, this silver nitrate solution discloses the fault, and will not stain sound tissue, except on the surface, where it is easily removed.

Black's extension for prevention is so generally understood, and followed, that it is rare to find failure of fillings because this principle has not been followed. I

have no figures to prove it, but I will make the assertion that 100 teeth are lost through failure to remove carious dentin, and failure to follow out occlusal faults, where there is one lost through failure to make extension for prevention. I therefore suggest that the term "extension for prevention" be broadened to include extending walls of cavities to include all caries, also to include all occlusal faults. Both are extension in the most literal sense, and both are extension for prevention, as truly as any surface extension could be. The two suggested additions are more immediate in result, because they deal with tissues already affected or soon to be affected by caries, while extension for prevention may deal with perfectly sound enamel, and would therefore be slower to break down by carious attack.

I am fully aware of the fact that Dr. Black advocated removal of all caries; also that occlusal cavities should include all fissure faults. The general failure to do so and the grave consequences merit a more prominent place in our teaching.

Extension of cavities to secure prevention is a rather concrete and definite matter. To remove all caries from cavity walls is quite another thing. All gradations and conditions are encountered. There is no line of demarcation at which we may stop and say, "That removes every trace of caries."

These observations on filling failures were not accumulated in one year, or ten years, but cover thirty years and more. There has been no more convincing evidence than mistakes of our own. My mistakes have been more valuable than my successes. Without failure, we can never attain success.

The greatest specialist that dentistry could know would be the dentist who would specialize in operative work for the adolescent child, limiting patients to from 10 to 20 years of age, during which time they would be carried through the period of great danger from dental caries, and during which time they should have their full complement of teeth, and cavities could be discovered early and filled.

Very few operators are giving any attention to those cupped-out abraded spots on the occlusal surfaces. Filling these will prevent the rapid wearing away of the teeth and closing of the bite. Gold foil is the one and only material with which this may be done. In this much needed service, operative dentistry is failing.

If operative dentistry is to regain her lost ground, and take her place at the head of the advancing profession, we must have the best operators teaching in our schools, never newly graduated students. We need more operative study clubs, especially in gold foil, and we need a national organization of gold foil operators.

Operative dentistry in particular, and dentistry in general, would be better served if there were:

Less exploring of questionable "nebular" subjects, and more exploring of the crowns of teeth with sharp instruments.

Less talk about cotton rolls, and more talk about the rubber dam.

Less talk about the softness of the meniscus, and more talk about the softness of decay left under fillings.

Less talk about wax expansion, and more talk about expansion of dentin with gold foil.

Less talk about the surgical removal of teeth, and more talk about the surgical removal of deposits around the necks of teeth.

Less talk bout health measures through removal of teeth, and more talk about keeping people well by keeping the natural teeth vital, clean and well.

Less use by pseudoscientists of incom-

prehensible terms, and more wisdom shown by using simple terms about simple things, so that more people will know what they are talking about.

Less talk about the "bite" and more talk about bitewing films.

Less talk about getting fees, and more talk about earning fees.

Less effort to get patients into the office through hand-shaking, and attendance of lodges, clubs and churches, and more effort to serve those better who come of their own volition.

Less effort in making good bridge players, and more effort to make good dental bridges.

Less talk about small fees, and more talk about small cavities.

Less worry about people not coming to our offices, and more worry about those who do.

Prevention of the misfits in dentures and inlays by stopping the misfit in his first year in college.

Less surveying of casts, and more surveying of dental filling failures.

Less social contacts, and more approximal contacts.

Less hand-shaking out of the office, and more hand-malleting in the office.

Less attention to social forms, and more attention to tooth forms.

Less attention to what the prospective dental student does before he enters college, and more attention to what he does after college.

Less curetting of sockets, and more curetting of caries out of cavities.

Less dry sockets, and more dry cavities and dry crowns during examination.

Less visual salesmanship, and more finishing of the invisible gingival margin.

Less surveying of dental problems in Europe, and more surveying of dental failures in America.

Movements of some of the names appearing weekly in the society columns, to the columns of the dental society program.

Less looking at the apices of roots and more looking at the crowns of teeth, where the trouble begins.

CONCLUSION

Control of caries by vitamin feeding, in our complex civilization, even though accepted in most of its tenants, is attended with insurmountable obstacles.

A man who cannot do good operative dental work should either specialize in something less exacting, prepare himself by postgraduate work or cease practicing.

That operative dentistry is failing is evidenced by the falling off in purchases of materials required to do the best operative work.

We cannot be held directly responsible for those who do not, for economic or other reasons, come to our offices, but we cannot escape the responsibility placed on us by those who do.

If a survey of operative work could be made, it would be of inestimable value. Not one in ten would have a rubber dam or the equipment for applying it. Instruments necessary to do good work would, in a great majority of offices, not be found. Even though they would have a technic for making well fitting inlays, they could not, in many cases, prepare the cavities for the inlays, remove the decay or cement the inlays, without the dam in place. If there is anything bacteria like better than brain broth, it is saliva-soaked caries covered with cement.

Gold foil, our oldest filling material, leads today as never before. It has been assaulted by every known cunning, to avoid work and condone incompetency, but when subjected to the acid test of long experience and pure reason, its arch enemies, incompetency, inertia and spoils, pale into flabby excuses of warped and prejudiced minds.

Caries, like cancer, if it is to be cured, must be discovered early and completely eradicated.

Only a dry, clean tooth can be thoroughly examined. Magnifying glasses, such as Beebe binocular loupes, a good mouth lamp, sharp explorers, a mouth mirror and bite wing films, supplemented with ammoniacal silver nitrate, are necessary to determine the condition of a tooth crown.

If we desire a better, closer relation with the medical profession, they must be informed, during their medical course, regarding what constitutes good operative dentistry. There is no ultimate in fillings. Try as we may, some of our fillings will fail, but this does not justify the miserable failures coming from a vast number of the offices of American dentists.

Preparation use of Howe's ammoniacal silver nitrate solution should be known by every practicing dentist in the world.

The dentist who makes a good dental filling performs one of the most difficult operations known to surgery. His monetary reward is seldom commensurate with the difficulty encountered, or the service rendered.

Take a look at the thousands of failing cement fillings seen in the front teeth of people in all walks of life and be convinced that operative dentistry is failing.

Operative dentistry has reached the crossroads. Will she meet this challenge, or will we accept the status quo with all its inevitable and disgraceful consequences?

RADICULAR CYST: REPORT OF CASE*

By THOMAS O. ROBINSON†, D.D.S., Berkeley, Calif.

ALTHOUGH the comparative frequency of radicular cysts is recognized, after reviewing the reports of such authorities as Leon Harris, of New York, and Robert H. Ivy, of Philadelphia, the following case is contributed from my service in Samuel Merritt Hospital because of the unusual size of the growth, the simple technic of its removal and the complete disappearance of the symptoms after operation.

REPORT OF CASE

A student, aged 20, had a painful swelling of the right side of the face and neck with constant headache and drowsiness. On rotation of his head to the left, the tension increased the pain, which was dull during the day but invariably became worse at night. This pain also involved the right shoulder. The patient described a sensation of constant pressure in the roof of the mouth and right side of face. He also complained of a "feeling of water" in the right ear, and blurred vision in the right eye, with lachrymation. At age 13, several teeth were filled, pain in the upper right lateral incisor following shortly. Six months ago, he was examined in a free clinic where dentigerous cyst was diagnosed and removal advised. No surgical work was done. The patient was referred to the dental staff of Samuel Merritt Hos-

*Read before the staff of Samuel Merritt Hospital, Oakland, Calif., Dec. 8, 1934.

†Chief of Dental Staff, Samuel Merritt Hospital.

pital, where he was seen by me Oct. 22, 1934.

The face showed great swelling and complete roentgenograms were made. Stereoscopic views of the head showed a clearly defined cystic area originating at the apex of the right maxillary lateral incisor, extending backward to the malar region of the upper second molar, encroaching on the maxillary sinus, pushing the floor upward and backward and extending forward and upward to the nasal fossa. Much edema was present in the palatal area and the egg-shaped mass was, upon digital examination, found to be quite movable but with no crepitus, buccal or lingual.

Fig. 1.—Appearance of patient on entrance to hospital, Oct. 22, 1934.

Fig. 2.—Appearance of patient on entrance to hospital.

On October 24, I extracted the upper right lateral incisor under a local anesthetic of 2 per cent procaine and epinephrine (1: 50,000 solution) withdrawing 3 c.c. of serous, straw-colored fluid from the cyst cavity. This, with a smear from the root of the tooth, was given to the bacteriologist, who reported "mixed flora, mostly streptococci, with few staphylococci and diphtheroids present."

Fig. 3.—Appearance of patient six weeks after operation.

Fig. 4.—Left lateral roentgenographic view.

This growth proved to be a radicular

cyst caused by chronic inflammation about the apex of the lateral incisor as a result of infection following the death of the dental pulp. This finding differed from that of the former diagnosis of dentigerous cyst in that there was no tooth or enamel

Fig. 5.—Right lateral roentgenographic view.

Fig. 6.—Left lateral roentgenographic view.

capsule present in the cyst cavity as found in follicular or dentigerous cyst.

Treatment consisted in surgical interference (Oct. 26) under a general gas induction. Nasal tubes were inserted and ether anesthesia was administered. The Ivy method was employed by making a curved incision from the second molar to 5 mm. to the left of the frenum anteriorly. The mucoperiosteal flap was turned up to expose the labial bone-wall of the cyst. This outer wall was removed sufficiently that the cyst sac was shelled out in its entirety by blunt dissection. No other teeth were sacrificed and the cavity was loosely packed with vaseline gauze and a drain inserted. The flap was sutured down in place. The cyst was exceptionally large, measuring 70 mm. in length, 43 mm. in width and 15 mm. at the apex. A section was sent to the

Fig. 7.—Left lateral roentgenographic view.

laboratory and the following report returned: "Benign, radicular cyst showing acute and chronic inflammatory reaction."

The pack was removed within forty-eight hours and the cavity irrigated daily for two weeks. The patient made a rapid recovery and was dismissed from the hospital fifteen days after the operation. All former symptoms have disappeared. Frequent electric pulp-tests show the remaining teeth on the right side to be vital with poor vitality of the cuspid and first and second bicuspids in which vitality is steadily improving.

CONCLUSION

1. This was an unusually large radicular

Fig. 8.—Cyst superimposed over roots of upper right cuspid and bicuspids.

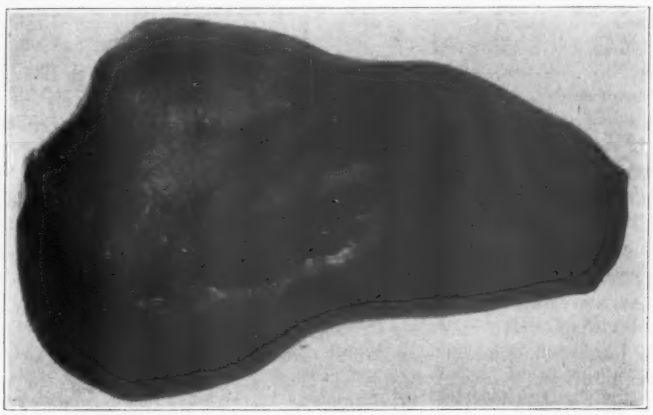

Fig. 9.—Cyst after mounting with 1 per cent solution of formalin gum-tragacanth and cotton.

cyst considering the age of the patient.

2. Only a minimum amount of bone-tissue was destroyed in the removal of the cyst.

3. No other teeth were sacrificed.

4. The patient made a rapid and satisfactory recovery with disappearance of all symptoms.

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COLD AND HEAT THERAPY IN DENTAL INFLAMMATIONS

By MATHEW PODOLIN, D.D.S., Buffalo, N. Y.

SHALL we use hot or cold applications in the treatment of dental inflammations? Certain authorities advocate cold in early inflammation, while others prefer heat, to prevent swelling. Contradictory opinions are commonly heard from reputable surgeons. A perusal of the early and current litera-

ture reveals merely that the same differences of opinion have existed ever since the therapeutic value of these two mediums has been given consideration in dental practice.

With the general practitioner, the problem is quite perplexing, and he frequently applies either one or the other, hoping that the treatment will have the desired result.

The time for mere guesswork is passing in the field of dental practice. Research and clinical experience are replacing the hit and miss methods with a more scientific accuracy. Taking a chance with either hot or cold therapy should no longer be practiced by the enlightened practitioner. Septic inflammation is frequently so serious that it becomes a question of life or death, and we dare not experiment with either heat or cold, but must use the therapeutic agent that science and clinical experience have proved to be the one of choice.

For ages, active hyperemia induced by heat has been considered favorable in its action in local inflammation. To what extent the induced hyperemia is beneficial can be understood only by a thorough knowledge of the reaction of the body against injury. This reaction, known as inflammation, is well defined by McCullum, as "a complicated vascular and cellular response which follows almost immediately upon the injury bringing forth much blood to the spot and pouring out its elements upon the injured tissue to prevent the extension of the injury, to hold in check the injurious agent or even destroy it." According to this definition, we already have a hyperemia induced by the reaction to an injury.

ASEPTIC AND SEPTIC INFLAMMATION

While the anatomic changes produced by trauma are essentially the same as those produced by the presence of an infective organism, the tissue changes in the first case are reparative. If bacteria invade the tissues, formation of an exudate, necrosis and degeneration are caused by the trauma and the presence of the toxic products of the bacteria. In other words, a distinction is made between the reparative processes that take place under aseptic conditions and those occurring in the inflammation associated with septic conditions. The septic inflammation designates a series of results of microbic interference with the normal process of repair in injured living tissues. The inflammatory changes in this case usually lead for a time to the destruction of tissue, but are ultimately conservative, the final result being the removal of the microbic agents.

In inflammation due to the action of micro-organisms, the blood vessels dilate under the influence of bacterial toxins, and stasis takes place, with exudation of serum, migration of leukocytes and proliferation of fixed tissue cells. The invading bacteria attract from the blood enormous numbers of polymorphonuclear leukocytes. The demand for these cells is met by the bone marrow. Chemotaxis may also be exercised by the proliferation tissue cells. The leukocytes, together with these proliferated fixed cells from the lymph and blood vessels, form a barrier around the invading bacteria, and the battle is on, the success of the defense depending to a large extent on the facility with which the leukocytes can be thrown into the field of action. The strength of this resisting wall depends on the virulence of the organism. The tissues soon become swollen and tense with an abundant serous and corpuscular exudate, the blood supply being thus lessened by pressure. Then begins that peculiar liquefaction of the surrounding tissue and exudate, which results in the formation of pus. Should the bacteria be

stronger than the resisting powers of the tissues, the liquefaction extends and the pus increases in quantity. The protecting walls are dissolved in this fluid, but new barriers are always being thrown up beyond, until, at last, they become strong enough or the enemy becomes so weak that the invasion is checked and the process of repair begins. The tissue cells form fibroblasts, which finally produce fibrous tissue. The waste products, in the meantime, are removed, the fluids by lymphatic and vascular absorption, and the solids, including bacteria, disintegrated cells and granular débris, by means of phagocytes. Thus, inflammation and regeneration, although distinct processes, go hand in hand. Regeneration begins where inflammation ends. This clearly illustrates that inflammation and suppuration are a beneficial excretory function of the body, always present and busy with small things, but called into exceptional activity by an emergency. Like other functions, they may sometimes result in harm, while in the main doing good. They localize invading bacteria and inhibit their growth or cause their death, and likewise prevent too rapid absorption of toxins, thus permitting the body to develop a sufficient immunity for its protection. Pus itself hinders the growth and distribution of bacteria and eventually kills them. Knowing this process, one can readily realize why artificial stimulation by means of hot fomentations is beneficial.

COLD

Cold is a very powerful and useful agent if used judiciously and applied at the proper time. It is valuable because of its reflex effect on the vessels of the inflamed area, rather than because of direct action on the cells or a part. The first effect of cold on the periphery is to cause contraction of all tissues of the skin, vascular, muscular and fibrous. The vessels of the interior correspondingly contract, and we have a tonic hyperemia in the particular area. We, therefore, have a local effect on the circulation when a primary contraction is followed by dilatation of the vessels, provided the application is brief enough. Too long an application causes paralysis of the cutaneous muscles, with an ensuing cyanosis, and a hyperemia perhaps, but of the atonic type.

Cold, if applied at all, should be used early in the case, that is, before stasis occurs. It is not to be used in the later stages of inflammation, for it will only aggravate the existing state. In fact, when there is considerable exudation, it does actual harm. If cold is kept on too long or is too intense, or if applied too late in inflammation, it lessens the nutritive activity of the cell, constricts the lymph spaces and channels, increases existing stasis and hence lowers the vitality of the tissue and may cause gangrene. DeNancrede, in his principles of surgery, points out that in an inflammation, stasis soon arises at the focus of inflammation. Cold benefits the hyperemic zone, but aggravates the stasis. DeNancrede says: "Judgment is, therefore, requisite to decide whether the evil at the focus will outweigh the good exerted at the periphery." He further points out that cold must not be used intermittently, but if employed at all must be continually applied. If cold is applied intermittently, there will be a reaction whenever it is removed, and this reaction causes increased hyperemia. Hence, cold must be continued in action to prevent reaction. Yet, if it is used continually, it becomes very dangerous, when the skin becomes purple and congested and the circulation is feeble. Cold should never be used in bacterial inflammation. In such an inflammation, it is desirable that quantities of active leukocytes and germicidal material come to the part. Phagocytes destroy bacteria

and circumscribe the inflammatory focus. Cold keeps much blood and hence many leukocytes out of the part, lessens the ameboid activity and prevents migration of leukocytes that do reach the area.

A frequent argument advanced by the proponents of cold therapy is that cold inhibits bacterial activity, thereby lessening the chances for the infection to spread. This argument is unsound and contrary to all bacteriologic findings.

The primary pus-producing organisms are *Staphylococcus pyogenes, aureus* and *albus* and *Streptococcus pyogenes.* The latter thrives best at a temperature of from 34 to 38 C., but is capable of more or less development in any temperature between 6 and 43 C. With other bacteria, the effect of heat depends much on the amount of moisture present and the particular culture concerned. They will usually withstand a dry temperature of 80 C. for one hour, but moist heat at 70 C. is quickly fatal. Boiling water kills these organisms instantly but they seem to resist moist low temperature, even repeated freezing and thawing. Prudden kept them alive in ice for sixty-six days. *Streptococcus pyogenes* thrives best at 37 C., either with or without oxygen, although capable of growing at 12 C., but not above 47 C. Hartman says that the organism will surely die at a temperature of from 70 to 75 degrees, but two days of freezing temperature is not fatal.

HEAT

In the early stages of infection, when the organism gains access to and is developing in the tissues, the body temperature is not elevated. After the reaction appears, the elevation of the body temperature occurs. This has a thermal inhibition on the bacteria.

A favorable temperature is essential to bacterial growth. The elevated temperature is essential to bacterial growth, stimulating all cellular activities of the body tissues, especially those concerned in the reaction against the invaders. Heat seems to accelerate all chemical reactions, thereby increasing the resistance to infection. There is a prevailing idea that heat hastens the formation of pus. This is true when the infection has progressed beyond the stage of possible abortion; in which case, local suppuration cannot be regarded as an evil. When suppuration threatens, hot fomentations cause a collection of multitudes of leukocytes, which tend to limit the area of infection and destroy bacteria. Even when suppuration is not prevented, heat aids in the rapid breaking down of the diseased tissue at the focus of inflammation, causing hordes of leukocytes to gather and encompass the suppurating tissue, preventing the spread of infection.

Many practitioners believe that inflammation is dangerous and must be counteracted. Inflammation is a danger signal, but not necessarily dangerous. The signs of inflammation indicate that something has occurred in the tissues which has brought about resolution on their part. Inflammation is not only a reaction to injury, as pathologists define it, but is also a process developed by nature to resist infection. It is doubtful that infection could ever be overcome without inflammation. Since inflammation is nature's way of fighting infection, we must work with it and not against it.

TREATMENT

In approaching a given case of inflammation, the first question should be: How did it come about? What is the probable cause of this reaction? The second: How is it to be treated? and as regards treatment, we must determine which in the particular case will insure the speediest and most definite return to the normal.

To prevent inflammation such as may follow extraction of teeth, cold is very efficient. It controls bleeding by contracting the blood vessels, and retards the migration of leukocytes to the traumatized area, thus preventing an edema. Cold should never be used continuously for too long a time, for it may cause stagnation and a lowered resistance of the tissues.

Cold may be used effectively to relieve pain from nonseptic pericementitis, to prevent ecchymosis and the formation of hematoma in cases of fracture and to relieve muscular inflammation after dislocation of the mandible; also in nonsuppurative glandular involvement.

The treatment indicated in septic inflammation is somewhat different from that in nonseptic. The object here is to destroy bacteria and to eliminate their toxins with as little damage to the tissues as possible. The chief difficulty encountered is the stagnation in the blood vessels and the lymphatics of the inflamed parts, so that no fresh blood is circulating through them. At the same time, the toxins formed by the bacteria act on the tissues and are absorbed into the blood, contamination resulting. By the application of hot fomentations, the blood vessels and lymphatics are emptied, the tissues are softened and relaxed and the blood flows more freely.

In a suppurative inflammation that has passed the stage of possible abortion, heat should be applied when localization is desired, or to facilitate drainage. Heat not only activates leukocytes and phagocytes, so necessary to fight the infection, but also stimulates the lymph circulation, thereby increasing tissue drainage, relieving the congestion caused by exudates and destruction of the pathologic process. This tends to reduce toxemia by washing out the tissues, accelerates resorption and promotes the function of tissue cells.

CONCLUSION

1. Cold is applied with benefit in some cases of acute inflammation resulting from trauma, but never in inflammation resulting from infection.

2. Cold checks inflammation by constricting the vessels of the hyperemic area, thus lessening the amount of blood sent to that part, prevents migration of leukocytes, retards self-proliferation and lowers temperature, thereby inhibiting the natural body defenses.

3. The application of cold in a suppurative inflammation has often been followed by necrosis and degeneration.

4. Cold, while beneficial in one stage of inflammation, becomes injurious in another.

5. It is questionable that heat would not be just as beneficial in traumatic inflammation as would cold.

6. Heat should be applied in all cases when localization is desired.

7. Heat should be applied in all cases in which metabolism is an important factor in treatment.

8. The therapeutic medium extensively used in most of the hospitals and by many oral surgeons is moist heat.

9. Moist heat has a soothing effect on the nerves, thus relieving pain, a very important factor in treatment.

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PLACE OF MYOFUNCTIONAL TREATMENT IN THE CORRECTION OF MALOCCLUSION*

By ALFRED PAUL ROGERS, D.D.S., A.M., Boston, Mass.

ORTHODONTIA, like medicine or surgery, is both a science and an art. It is a science because its understanding requires a knowledge of the biologic sciences. It is an art because its therapeutic aspects demand the ability, on the part of the orthodontist, to understand the application of mechanical principles that certain harmonious developments may be effected in the attempt to develop form and symmetry in the dental arches and the soft tissues of the face.

During the developmental years, because of the absence of a comprehensive understanding in the beginning, it has not been able to progress uniformly in all the phases necessary for complete development. Individuals in the profession have devoted themselves to subjects which have seemed native to their ability, and a few have attained eminence in several collateral subjects. Some have become proficient in biology, other in anthropology, and their investigations have thrown considerable light on essential phases of the work.

The continuous devotion of these men has done much during the past thirty or more years to place orthodontia on a plane of high achievement, and there is little doubt that, through the years to come, other scientific investigations will shed needed light on some of the problems still confronting us. Although we take just pride in these achievements, we must admit that, by many, orthodontia is conceived as merely an art or a practice. That is to say, the mental processes of many practicing orthodontia are largely concerned with the construction and application of mechanical appliances, many giving more serious thought to the problems of mechanical tooth movement than to the biologic factors in malocclusion. This is probably inevitable because of the fact that the orthodontist is daily confronted with problems that appear to him solvable only through the agency of applied mechanics.

There are certain principles which are based on the biologic facts underlying growth and development, tending to minimize the use of mechanics by placing stress on natural and fundamental processes of development. It is well to remind ourselves at this point that, in the early stages of life, the development of functional elements continues until certain structures have attained a state of practical usefulness. From this point, then, it is necessary for the further development of these structures that function continue the development, and that the ultimate form and structure depend on the nature and degree of function the individual is able to bring into use. Structural development never achieves its proper form unless function is performed in such a way as to produce it. In speaking of minimizing the application of mechanics, it must be kept clearly in

*Read before the Section on Orthodontia at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 20, 1935.

mind that in no wise is the value of mechanical principles as applied to orthodontia depreciated. The underlying idea is that we learn to appreciate the possibilities of the simplest form of mechanical application, and, at the same time, by persistent study, come to take advantage of inherent forces, in order that we may, when necessary, safely discard mechanical procedures in the interest of normal processes of growth. My experience of recent years has taught me that it

Fig. 1.—Correction of distoclusion by use of myofunctional treatment without use of appliances.

is difficult for some to appreciate the essential values that may be derived from thinking of the subject in this manner.

There are those who persist in the application of most complicated mechanical apparatus, seeming to work on the theory that there exists no natural tendency toward normal development of the jaws and facial bones without mechanical stimulation, forgetting that there is such a thing as physiomechanics, and ignoring the fact that each individual has been provided with living orthodontic appliances which, when properly understood, may be utilized quite as efficiently for the attainment of some forms of development as any mechanical appliance yet devised. It may even be asserted that certain developments are possible through the use of these living agencies that are not at all attainable through the use of mechanical aids. Many seem unaware, when correct form or normal development is attained by the use of these living orthodontic appliances, that, in large part, mechanical retentive appliances may become less important. The treatment of malocclusion with the aid of the living orthodontic appliance is now becoming known as myofunctional therapy. The observation of the muscular habits of many young children gave the first clew

to the possibilities inherent in the idea. The logic consisted in the observation that, through the maluse of certain muscle groups, many children succeeded in producing malformation of the dental arches and the contiguous bony tissues. The simple deduction following these observations was that, by the correction of these forms of malfunction, further maldevelopment could be inhibited, and, on some occasions, when normal muscular action had been restored, an improvement in arch form began to manifest itself. From this point, it was possible to go on step by step until it was found that by further and persistent attention to these principles, additional advantages were obtainable. It is the purpose of this paper to enunciate some of these principles, and to illustrate the resulting tendency toward more normal development.

Fig 2.—Lingual wire offering simplest form of mechanical aid in obtaining general development of arches.

The correction of malocclusion has sometimes been referred to as dentofacial orthopedics. Nothing gives greater support to this title than the results obtained by the application of myofunctional therapy. No case of malocclusion should be thought of as completed, irrespective of the method used in obtaining tooth position, unless there also has been instituted methods of a myofunctional nature having for their purpose the establishment of a harmonious relationship between the dental arches, together with coordination, balance and the development of tone in all the muscle groups related to facial development.

It is quite essential that those who become interested in the myofunctional phase of orthodontic treatment familiarize themselves with the muscular structures of the face and neck, paying special attention to the muscles of mastication. During this study, they should be careful to acquaint themselves with the normal functional muscular movements. As an aid to this study, I would recommend the work of Frederic Pomeroy Lord, "Observations on the Temporomandibular Articulation." After a careful study of Lord's experiments, the student will be better able to evaluate the stresses which occur during the various movements of the jaws in response to contraction and relaxation of the masticatory muscles. Having become familiar with the normal functional movements, interested observers will be in a position to appreciate the destructive possibilities inherent in these muscular tissues if, for any reason, their function becomes diverted from the normal.

The significance of function in developmental processes has been clearly ex-

pressed by many physiologists, and the orthodontist should give sufficient heed to their conclusions to be able to evaluate the possibilities of the proper use of all functional elements. If, then, by increase in function, arrested or retarded development may be stimulated toward the normal, the orthodontist must realize that he should plan his treatment with the idea that the teeth, the surrounding bony tissue and the muscular tissues be rendered normal in the best, easiest and quickest way that has been found possible.

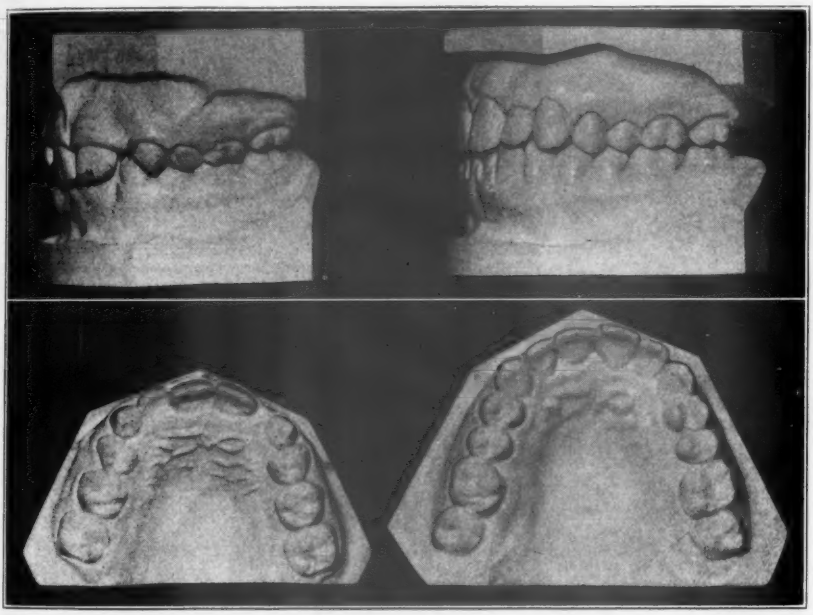

Fig. 3.—Result of use of lingual wire on mandibular arch and masseter-temporal exercise; maxillary development from 1 to 4 mm.

In very young patients generally, and in older patients in particular instances, there may be important preliminary changes brought about by the stimulation of function prior to the employment of any form of mechanical appliance. This concept is difficult of immediate acceptance by many to whom the idea is novel. It requires experience, repeated application and long observation for one to sense the often slight changes in form which may be produced by this method. For that reason, I am not going into any detailed explanation of this phase of treatment, but shall mention the possibilities, reminding you that, as a preliminary measure, it has proved highly beneficial in certain types of malocclusion, especially when the patient is by nature responsive to the suggestions of one who is proficient in explanations regarding the correct method of application. (Fig. 1.)

I shall confine myself for the most part to the method of treatment which calls for the simultaneous employment of myo-

functional treatment and the minimum use of the simplest and most delicately constructed mechanical aids; i.e., a demonstration of the coordinate use of the natural and artificial means of growth stimulation, the natural consisting of the proper employment of the living orthodontic appliances, the artificial of the limited and intermittent use of the mechanical. In pursuing this method of treatment, the orthodontist must realize that the most valuable appliances for his purpose are those which interfere least with the normal tendencies of development and, in their construction and adaptation, are most nearly free from interference with normal muscular activity. It will be evident to him, at the same time, that he should, whenever possible, avoid appliances that may carry with them the possibility of stimulating undesirable muscular habits, as the harmonious action of muscle groups will be found quite as important as their increased strength when used as aids to treatment. After months or years of experience, the careful student will learn that developments brought about by the aid of increased function calls for less retentive apparatus than development brought about by mechanical means alone. He will attain the knowledge that an understanding of the normal processes of nature, together with an intelligent reeduca-

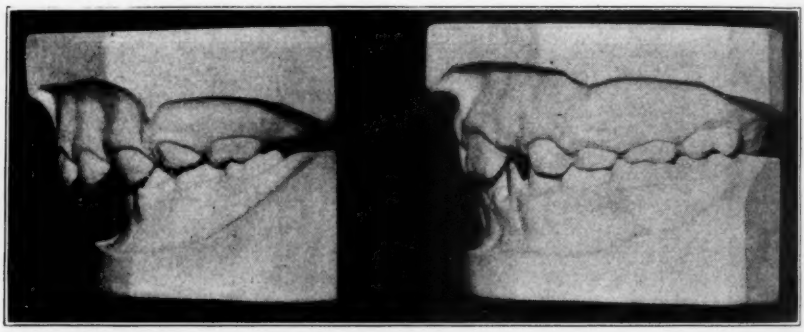

Fig. 4.—Correction following myofunctional method of treatment for distoclusion with junior labial appliance used on maxillary arch.

Fig. 5.—Junior labial appliance.

tion of whatever is abnormal in the oral development, constitutes the scientific basis upon which modern orthodontics should rest.

Experience also will teach that well-developed facial muscles are more beautiful, and that desirable facial contour and symmetry are much more in evidence than is the case when the correction has been achieved through mechanical means alone.

The archaic practice of the extraction of the first molars, which is even in this day advocated and practiced by men who are untrained in modern orthodontics, can have no place whatever where treatment is carried on by myofunctional methods; for the good reason that the myofunctional method seeks to assure the normal development of the dental apparatus, including all its functionally related parts; whereas, extraction makes forever impossible possession of a normal denture.

The initial efforts, in this method of treatment, should be confined to the sim-

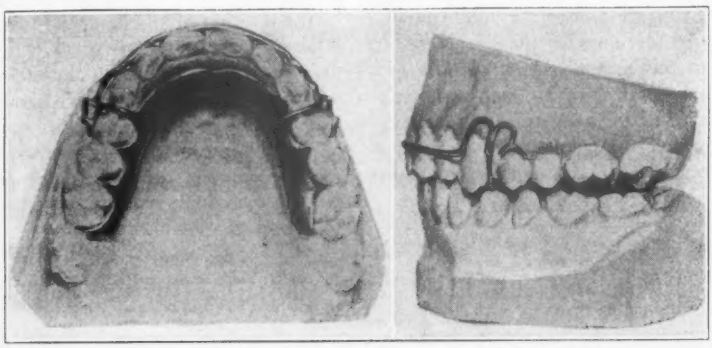

Fig. 6.—Hawley retainer, to be used when infraversion is present in molar and bicuspid region.

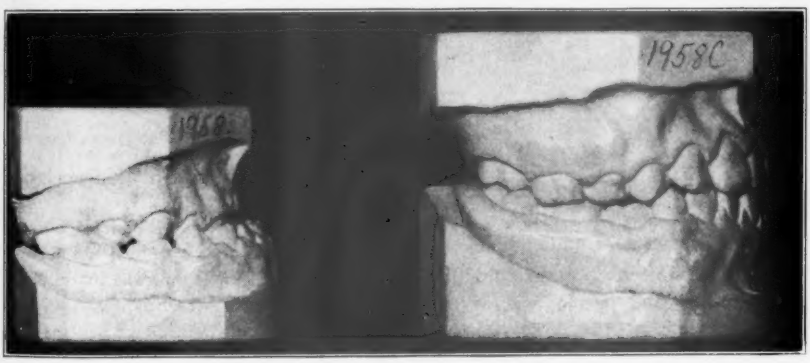

Fig. 7.—Mesioclusion; correction obtained in three months. The normal model was made five years after the initial treatment.

plest forms of malocclusion, the operator learning to make application of myofunctional treatment to these forms until its value becomes apparent to him. At the beginning, then, he should select cases representing simple neutroclusion in slightly arrested development where the arches are in the proper mesiodistal relation. Such cases are frequently found among young children under the age of 6. In cases of this nature, the application of a simple lingual wire on the mandibular arch is all that is required in a mechanical way. After this application, mechanical treatment of the case consists in so de-

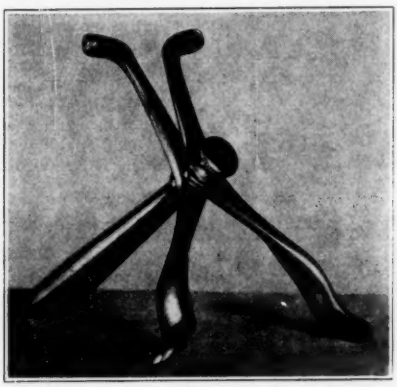

Fig. 8.—Exerciser found useful in increasing tonicity of orbicularis oris muscle.

veloping the lingual wire as to produce a very gradual and harmonious development of the mandibular arch. (Fig. 2.) After the patient has been given a short time to become accustomed to the appliance, he is directed to give his attention to the development and control of some important groups of muscles.

The most useful exercise at this period is the one known as the masseter-temporal, which, of course, in its performance, includes other groups, such as the internal pterygoid groups. This exercise is valuable during some phase of the treatment of most forms of malocclusion. It is especially valuable as a retentive measure, often entirely dispensing with the retention of the maxillary arch. This exercise consists in the alternate contraction and relaxation of the masseter-temporal group of muscles, with the mandible held static in the position of mechanical advantage. This exercise should never be permitted unless the patient is able to place the mandible in correct position. He should be instructed, when learning this exercise, to place the tip of the forefinger over the masseter muscle near the angle of the mandible, to enable him to sense the contracting and relaxing movements.

After a few weeks or months, it will be noted that the maxillary arch shows a tendency to increase in size, gradually approaching its normal form. In such simple cases as are being considered, this phase of treatment is complete when both mandibular and maxillary arches are approaching normal development. (Fig. 3.)

After learning this simple process, it will be readily understood that a similar technic may be used in the development of simple neutroclusion in older children.

The student is now in a position to undertake the treatment of distoclusion in the young child.

In the treatment of a dental anomaly such as is shown in Figure 4, frequently no apparatus is needed on the mandibular arch. In anomalies of this character, the narrowed maxillary arch presents a mechanical disadvantage which makes development impossible without mechanical interference. Therefore, a light 28-gage wire appliance is attached labially to the molars and cuspids. (Fig. 5.) This appliance is first constructed to fit the deformed arch and then molded into the desired shape and applied. Instructions are given to have the child employ the pterygoid exercise and, when the inter-

ference of the maxillary arch has disappeared, to have him place the mandibular arch in a position of mechanical advantage and begin the exercise of the masseter-temporal muscles. After a short period, the patient is able to place the mandibular arch in its normal position. The next step is the exercise for strengthening the orbicularis oris and other muscles of the face.

The pterygoid exercise consists in placing the mandibular incisors anterior to the maxillary incisors, if the maxillary incisors are near their normal position. If the maxillary incisors are much protruded, no attempt is made to place the mandibular incisors anteriorly to the maxillary incisors, but they are advanced only to that point which could be considered approximately the normal position. The patient is then instructed to relax the external pterygoids and allow the mandible to recede to the point where the arches are in their relatively correct mesiodistal relation. A correct conception of this simple exercise must be borne in mind at all times, as it is at this point that many have erred. As a result of these continued efforts, the physiologic habit relative to the mandibular position gradually develops, entirely within the normal rotational function of the mandible. This exercise may be considered as a setting-up drill resulting in the necessary added tonicity and control of position.

Having learned the application of the external pterygoid exercise and the masseter-temporal exercise to this simple form of distoclusion, the student will be able to proceed with the treatment of the older and more complicated forms. He will realize that he should at all times bear in mind the importance of establishing a position of mechanical advantage by the removal of interference, and, in some cases, where infraversion of the molar and bicuspid teeth is observed, to provide an artificial means of mechanical advantage by the use of the modified Hawley retainer, or some other efficient form of inclined plane. (Fig. 6.)

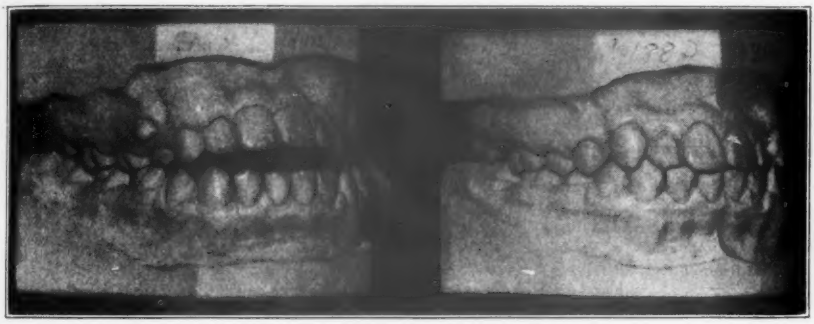

Fig. 9.—Anterior infraversion corrected without use of appliances.

In the treatment of mesioclusion, the student, if possible, should make his initial efforts on the deciduous teeth. He is instructed to make application of the usual mechanical technic with delicate labial wires on both arches, and the use of intermaxillary elastics. The use of the elastics is of a temporary nature in the treatment of mesioclusion, and their application is necessary only until the in-

clined planes are approaching a position of mechanical advantage. The intermaxillary elastics are then discontinued and the masseter-temporal exercise is substituted. This exercise is performed exactly as described in the treatment of a simple case of neutroclusion. It will be found by following this method that the mesioclusion is soon corrected, and that it will be safe to remove all appliances when the masseter-temporal muscles have developed to a sufficient degree of strength. (Fig. 7.)

Having learned the value of this method of treatment with the very young, the student, as in the former cases, may now begin the application of these principles to older patients. During the course of his efforts, cases will be encountered wherein troublesome reflex tongue habits will need to be overcome. When this condition arises, it will be necessary to give careful thought to the psychologic factor.

As an accompaniment to the masseter-temporal exercise, the tongue exercise is one that has particular virtue. It teaches tongue control and strengthens those muscles which are particularly influential in the development of the mandibular arch. After the child has learned the masseter-temporal exercise, he is instructed to place the tip of the tongue against the mucous membrane of the alveoli directly beneath the mandibular incisor teeth and, with each contraction of the masseter-temporal group of muscles, press the tongue against the anterior section, at the same time, by the act of widening the tongue, forcing it against the lingual surface of the alveolar process. These controlled movements aid the tongue to function in a more nearly normal position and have a tendency to prevent the narrowing of the mandibular arch, thus facilitating the early removal of retentive appliances.

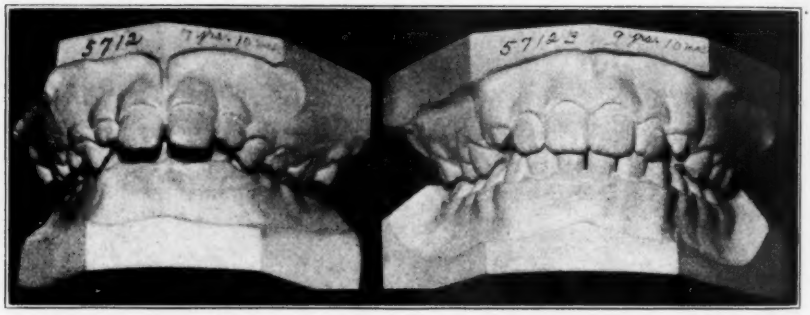

Fig. 10.—Treatment by employment of simplest form of appliance together with myofunctional exercises.

The next exercise, which is termed the general tonic exercise, gives evidence of assuring satisfactory results. It promotes a more copious blood flow to the tissues and is valuable in adding tonic qualities to all the muscles of the face. One needs but to give it a few days' faithful personal trial in order to realize its value. It has great prophylactic worth, consisting in taking a copious sup of warm water in which has been dissolved a portion of either sodium bicarbonate or sodium chloride, and, with the teeth held firmly in occlusion, forcing the water through the interproximal spaces into the buccal

cavity, then back into the lingual space; action being continued until the muscles show slight fatigue. This exercise should be repeated five or six times morning and night and continued after the cessation of all other treatment.

The orbicularis oris exercise is best performed with the aid of an exerciser so designed that it is difficult to keep it within the aperture unless the muscle is properly contracted. During its use, the patient should not allow the instrument to stretch his lips. It must not be overlooked that the orbicularis oris muscle is composed mainly of two sets of fibers, not to consider the fibers of the muscles which intersect. In making the efforts with the exerciser, this should be kept in mind, these fibers being held in as nearly normal relation as possible. If the patient is allowed to curl the lips during the exercise, the effect on the orbicularis oris muscle is not so favorable, but if the fibers are kept in the position which they assume in pronouncing the letter p, a more satisfactory development is obtained. This exercise is continued with one elastic during the first week or two, and contractions are increased each day until they reach fifty or sixty. When the muscle grows in strength, an increase in the number of elastic bands may be made. It is rarely necessary to employ more than two elastics. The child is taught to control the extent of action of the rubber bands. It is not wise to overload the muscle, because, as is well known, any muscle tryipg to lift a weight beyond its ability is liable to sustain injury. The weight which the muscle should lift must be well within its capacity, increased contractions making up for the lighter task. (Fig. 8.)

The reflex muscular movements of the tongue are to be accepted as the principal cause of infraversion of the anterior teeth. Its primary correction is usually effected by the use of appliances of one sort or another, and, if the proper technic is used, the infraversion seems to be readily corrected; but it is well recognized among orthodontists that long retentive periods are necessary and, even after prolonged retention, the same malformation is liable to again develop when the mechanical retentive apparatus has been removed. In the treatment of this type, myofunctional treatment will be found of value. In numerous instances, this form of dental anomaly has been corrected without the employment of the usual mechanical aids, but, through lack of complete understanding, few seem to be able to carry treatment through to a successful termination. In certain individual cases, it has been found expedient to employ the two methods simultaneously. When this is done, the correction is much

Fig. 11.—Change of condyle position following myofunctional treatment.

more quickly effected and the period of mechanical retention is very greatly lessened.

The following case of rather extreme infraversion yielded to the myofunctional treatment without the aid of apparatus. (Fig. 9.) The patient's abnormal tongue movements consisted in placing the anterior section of the tongue between the teeth to the left of the median line, using a sucking motion which apparently brought pressure sufficient to influence the development of the left half of the maxillary alveolar process. The study of the maxillary model will reveal this. After a careful study of the case, it was decided to undertake treatment, first by removing the interference found in the distal portion of the maxillary arch, consisting of a slight lingual development. A lingual wire was adjusted to the maxillary arch and the lingual position of the molars was corrected. This phase of treatment was of very short duration and, when completed, was immediately followed by instructions having for their objective the development of the masseter-temporal group of muscles and the correction of the faulty tongue movements. Instructions were given in a series of movements for the tongue tending to prevent a continuance of the habitual faulty movements. The instructions given the patient resulted in the withdrawal of the tongue from its abnormal position and the placing of the tip against the mucous membrane of the anterior portion of the lingual surfaces of the mandibular alveolar process. At each contraction of the masseter-temporal group, an accompanying movement was made by the tongue, consisting in a slight forward movement immediately preceding the widening of the dorsum of the tongue. The patient was instructed to continue these movements in rhythmic fashion two or three times a day and, from a count of fifty or seventy-five at the beginning, to increase gradually until several hundred contractions were made daily. The im-

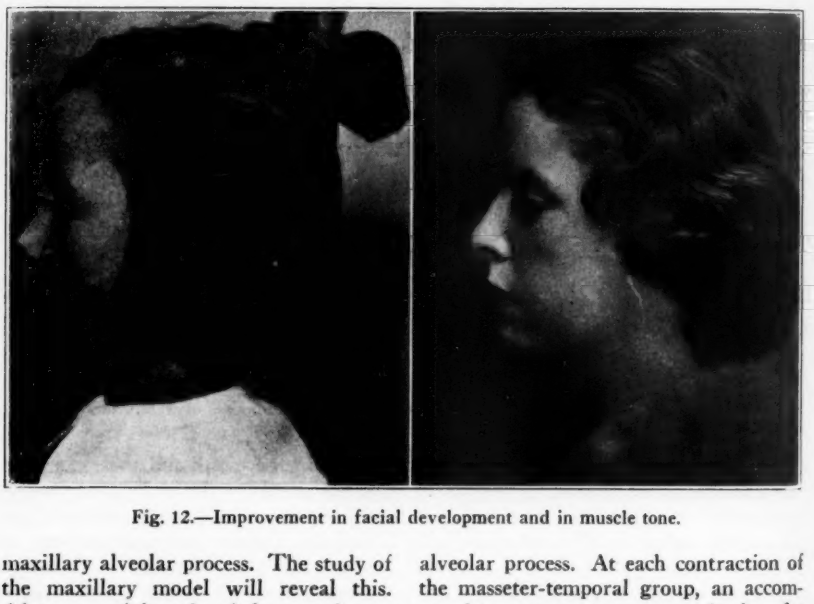

Fig. 12.—Improvement in facial development and in muscle tone.

portance of keeping the lips in apposition, especially during the exercise, was carefully explained. The lingual wire was then removed from the maxillary arch. The foregoing instructions were given just before the patient's summer holidays, and he was sent away for the summer without any mechanical apparatus, but with definite instructions regarding the use which he was expected to make of the important muscle groups involved. On his return, a gratifying change was seen to have taken place. The orbicularis oris exercise was then prescribed with the hope of bringing about desired tonicity of the orbicularis oris and attached muscle fibers. The result obtained by this form of treatment supported my conviction regarding the fundamental soundness of the idea.

I am, of course, fully aware that, in some persons, it would be impossible to attain such a result by the employment of the foregoing method.

There is much more in orthodontia than the use of appliances for the correction of various forms of dental anomalies. The matter of judgment in selecting the type suitable for certain forms of treatment, and the judgment and thoroughness with which the instructions for self-improvement are given, are factors of first importance if a successful termination is to be expected.

A study of this case should have the following reaction: If it is possible, through the use of the principles of myofunctional therapy, to correct a tongue habit capable of producing and maintaining a marked infraversion, so that the deformity disappears without the use of any other means, the first duty of the orthodontist should be to employ this method conscientiously from the very beginning of treatment. If the correction does not spontaneously follow, the simplest possible form of appliance should be employed, and, at the same time, myofunctional principles should be employed for the purpose of simplifying the correction, and shortening the period of retention, by correcting the reflex movements of the tongue.

The student should bear in mind that nature works slowly but accurately when directed in her proper course. It is impossible to show by casts and photographs the actual results achieved. The physical changes go far beyond where the eye can reach or the fingers sense. The tissue changes are not always caught by the camera or exemplified in the casts. The patient is, in all probability, benefited far beyond the range of our observation.

An unusually severe type of malocclusion, and which is usually considered difficult of treatment, is shown in Figure 10. By the intermittent use of appliances of a simple nature, and the constant employment of myofunctional principles of treatment, this case has undergone correction which gives promise of permanence. The musculature has been developed to a marked degree, and from a condition of severe dental crippling, a normal occlusion efficient in all its functional requirements has evolved.

In recent years, we have been carrying on roentgenographic observations of the temporomandibular articulation in order to evaluate the changes in form affecting the position of the head of the condyle in its relation to the glenoid fossa in cases of distoclusion. These observations have established the fact that changes in form actually take place, and the changed position of the head of the condyle coincides with the establishment of correct action of the mandible in its various functional movements in speech and mastication. To arrive at this conclusion, it is necessary first to obtain roentgenograms of the temporomandibular articulation with the arches in distoclusion. The second roent-

genogram was taken with the arches in a consciously controlled position of neutroclusion. These two roentgenograms exhibit a variation in position, the first, or distal, position being represented by the head of the condyle well seated in the distal portion of the glenoid fossa, and the second position, representing the patient holding the mandibular arch in normal position, showing the head of the condyle descending the distal incline of the eminentia articularis. During the progress of treatment by the myofunctional method, occasional roentgenograms are taken which reveal a progressive backward movement of the head of the condyle coincident with the reestablishment of normal occlusion, until finally the head of the condyle reaches its former position in the glenoid fossa, as represented by the first roentgenogram. It may be noted that when the condyle head has finally attained its former position, the patient's mandibular movements have become normal, and that the ability to retract the mandible during the act of mastication, or in speaking, has been lost. From this evident change in form, we conclude that, under the continued functional stresses with the arches functioning in normal position slight and distributed changes in form have taken place in the alveolar process, the neck of the condyle and other parts of the mandible where the muscular stresses have had their greatest influence. In my roentgenographic technic, I have found it impossible to fix definitely the location and extent of these changes except as has been illustrated by the change of the condyle position. (Fig. 11.)

These experiments have confirmed the truth of assertions made repeatedly by physiologists that function determines form. The various changes in the form of the dental arches, and the changed position of the head of the condyle in distoclusion cases, have been illustrated. Among the changes that take place in the soft tissues of the face after this method of treatment, will be noticed significant changes in contour. (Fig. 12.) There seems to have been established an improved tonic condition of all the soft tissues involved.

I have endeavored to make as clear as is possible in one brief presentation the place of myofunctional therapy in the treatment of malocclusion. The material presented is merely an outline of the underlying principles and technic of accomplishment. A deeper understanding of this method of treatment can be acquired only by careful study and conscientious effort.

ADDRESS BEFORE THE PAST PRESIDENTS' CLUB*

By JOHN V. CONZETT, D.D.S., Dubuque, Iowa

FIRST let me express my appreciation of membership in this exclusive organization, the Past Presidents' Club of the American Dental Association. I am aware of the fact that you are not responsible for my being with you; neither am I in any degree accountable for the fact that you are members of this organization. Our fellowship is the gift of the American Dental Association, and we as members can neither deny that right nor accord it to any man, and that makes us a peculiar organization, and

*St. Paul, Minn., Aug. 7, 1934.

membership in that organization of all the more value. While we are not responsible for the memberships each of the others, and must take the dictum of the A.D.A. for our continued existence, I can truly say that though I have been associated with many organizations, civic, social, sacred and professional, I have never felt more pride in any organization, or had more truly a feeling of fellowship for the members than I have in the organization to which we belong. Perhaps this is natural; for I can say, without being charged with gross egotism, that members of this body are the pick of the dental profession of America, and it is natural that the outstanding members of an organization of that magnitude must be men of higher attainments than are ordinarily found in associations of equal numbers. Fellowship in this club has meant a great deal to me, and each year that feeling is stronger and the comradeship deepens and grows richer with each succeeding year.

In presenting the address of the year, I am following a custom that was inaugurated some years ago. I have noted that it has been the habit of the men who have preceded me to take for their topic some event or events that led up to their administration, or the dominant thought of their time in office. In thinking of my professional activities, and the dominant motives in my career, I am impressed with the fact that the study club and the part that I played in many such organizations was the factor that made it possible for me to make any impact upon my fellows in the profession. Therefore, I shall discuss this afternoon the genesis and evolution of the study club as it became a power in modern dentistry.

In 1891, G. V. Black published his epoch-making papers on operative dentistry, in the *Dental Cosmos*. And let me here pause to pay a tribute to that great man. In my opinion Dr. Black was the greatest scientist that the dental profession has ever produced, and I venture the opinion that never again will his equal be found, for the times that made Dr. Black possible have passed. We may have greater operative dentists, greater physicists, greater dental anatomists, greater pathologists and greater teachers, but, in this day of specialization, we will never have in one man a dentist that will box the compass of scientific and practical procedure as did Dr. Black. Even in this day of opportunity and specialization, the works of Dr. Black are still paramount. His "Operative Dentistry" is still the accepted textbook in the majority of colleges, and is the standard by which all others are judged. His "Dental Anatomy" still leads the thoughts of the student in that line. His "Dental Pathology" is still outstanding, and his work on the physical characteristics of gold, amalgam and the human teeth are classics that will endure as long as dentistry is a profession.

On the publication of the work on operative dentistry, in 1891, a young man in St. Paul read the book and became so imbued with the thoughts contained in it that he journeyed to Jacksonville, Ill., the home of Dr. Black, and begged the privilege of studying with him in his office for a little while. This man was Edward K. Wedelstaedt, of dominant personality, a genius for hard work and an enthusiast for all that was good in dentistry. Dr. Wedelstaedt drank deeply of the fountain of Dr. Black's genius and then and there became an ardent student and disciple of Dr. Black, devoting his life to the propagation of the truths he learned at his feet. Dr. Black was the acknowledged master, but Wedelstaedt was the Paul, the Peter and the John that took the teachings of the

master and spread them to the four winds of the dental profession.

Dr. Wedelstaedt went home to St. Paul, and not content to take of the things that he had learned and give them to his patients, called in some of his dentist friends, told them of his wonderful discovery and with them organized the G. V. Black Study Club and began to teach Dr. Black's methods. Soon, the members of the club became so proficient in the methods followed that they decided to give a clinic. This became an annual affair, and so great was the success of their efforts that men from all parts of the country journeyed to St. Paul to attend these annual clinics of the G. V. Black Club.

I was among the men who attended these clinics, and, for some reason—perhaps because he saw my dire need—Dr. Wedelstaedt asked me if I would like to come into his office and study the methods. This opportunity was eagerly seized, and for some time I was privileged to stand at Dr. Wedelstaedt's chair to watch him operate, then go home and put into practice the truths gathered there. One day, while at his chair, he said, "Why don't you go home to Iowa and organize a club? and I will come down and teach you." This opportunity was eagerly embraced, and we organized the Wedelstaedt Club of Iowa, from which were graduated many of the operative dentists of whom Iowa became proud. Clack, Beemer, Finn, Slingluff, Pherrin, Work, Cook, Jacobs and I became the first members, and the club grew in influence and numbers. The news and prowess of the club became common knowledge, and others coveted the opportunity that was ours. Charles E. Woodbury asked Dr. Finn and me to come to Omaha and organize a club, which we did, and this was the genesis of the Woodbury Club, which has done such valiant work in that section of the country. Dr. Finn and I went to Omaha for several years and then the work went on as Dr. Woodbury carried it to further heights.

Then came the call to New York, and I went there and organized the New York Study Club, returning twice a year for several years, the outgrowth of which is the excellent work that is now being carried on by the organized study clubs of New York. Clubs were organized in Peoria, Ill., Springfield, Ill., and many other places as the good news was carried from place to place. In 1905, I was president of the Iowa State Dental Society and, in my presidential address, I advised the organization of study clubs under the auspices of the society. The suggestion was avidly received and acted on and, as chairman of the study clubs, I organized clubs in gold foil, porcelain inlay, dental prosthetics and pathology. The last named club was taught for several seasons by our talented member Dr. Logan. These clubs accomplished a world of good, stimulating men to better work and developing a love of study and an ambition for better work in all directions. The idea spread and clubs were organized all over the country; but, as in all good things, with the good, evils crept in. Commercialism never misses a chance to pick a dollar from anything that gives promise of good picking, and men began to capitalize the study club idea. Men of more or less ability began to organize clubs here, there and everywhere, and to teach the members for so much a pupil. This began to be a scandal in the ranks of the profession. About this time, I was elected to the Presidency of the American Dental Association, then the National Dental Association, and the background of my training, being dominant in my mind, I began to study the method of bringing the study club into activity as

a part of the American Dental Association and I worked out the idea that was presented in my presidential address, the salient factors of which were that the Association should sponsor the study clubs, through committees appointed for that purpose, the central committee having supervision over subsidiary committees in the various states and formulating plans and curriculums and furnishing teachers for these organizations. The plan was well worked out, but required the cooperation of the men in the colleges, for the dominant idea was to make of the study clubs a means of university extension and not allow any or every person who thought that he had some ability to organize a club for gain. It was purposed that the work be carried out by men of undoubted ability in the teaching line, and that, in the end, the student should be given academic credit for his work. In the furtherance of this idea, the American College of Dentists was conceived, with the idea not only of recognizing the work that had been done by worthy men in the profession, but also stimulating a desire for work in the study clubs by the conferring of fellowships on men who had accomplished a certain amount of real work in the study clubs, as worked out by the men having the curriculum in charge.

The idea was enthusiastically received by the members of the A.D.A. and it was voted to inaugurate the plan. The American College of Dentists was organized at the same meeting and it seemed that my dream was to become a living reality, but, alas for human ambitions, dreams do not always come true. In order to consummate the plan, the cooperation of the colleges was needed, and this I thought would be assured, as it was planned to use college men in furtherance of it. While there was no open opposition to its fulfillment, there are forces of inertia that are sometimes harder to combat than active opposition, and such forces proved the undoing of the plan. The thought of the college men who were not enthusiastic in support of the study clubs was that it was the province of the colleges to carry on graduate work. That is granted, but even though some of the colleges have undertaken postgraduate classes, and they have in a way been successful, in large measure they have not embraced the opportunities that exist.

If the mountain would not go to Mohammed, Mohammed would go to the mountain, and the large majority of men in the profession would not, or could not, go to the colleges, so the colleges should have gone to the profession. This was the idea of the study club. That it was a good one, and that the profession welcomed it, was demonstrated immediately by certain commercial interests, who avidly embraced the study club method. Persons of more or less ability began to organize classes, and the various dental depots and supply houses took up the game, until the country was flooded with circulars from these places, organizing classes in various places, exacting a fee for membership, while others gathered men together for the purpose of teaching some method that required investment in certain instruments or devices in order to produce results. All of which became such a stench in the ranks of the profession that the American College of Dentists refused to confer fellowship on the men who were addicted to commercial teaching. The men of the profession realized their deficiencies, and in lieu of professional teachers, eagerly sought the help of commercial teachers. I am not one who depreciates the good work that many of these men accomplished, for many of them were good teachers and accomplished much in helping the men in practice to raise their standards and

give better service to their patients. But the sad feature was the fact that the men of the rank and file were not competent to judge of the fitness of the men who came to teach, and much harm resulted.

That the American College of Dentists has not absolutely lived up to the ideals of the organizers is not the fault of the college, for the opportunities that were to have been given it were denied by the failure of part of the program. Doubtless, it is all for the best, for I am aware that my vision is decidedly myopic and I can see only the practical, that which is near at hand; while the men of hyperopic vision, who with prophetic eye can reach into the future, are better prepared to steer a course that will more perfectly fit into the changing conditions as they will prevail in the better days that we hope are to come.

As I have read over the foregoing, I am struck with the thought that perhaps some of my hearers may think that I am giving voice to disappointment in the failure of my dreams and that I am criticizing the members of my profession for that failure. Such is not my intention. I am not sitting on the critics' bench; I am simply trying as a historian to tell that which was and that which might have been. Neither am I essaying the rôle of a revivalist attempting to bring to life a lost cause. Personally, I am not interested in the organization of study clubs in the A.D.A. The work that I may have done in that respect in the past is just so much water over the dam. I have no criticism for my profession, nor for any of the men composing it. My profession has honored me far above all that I have been able to ask or think, and certainly far above my deserts, so that I have only love for it and for the members composing it. My entire devotion now is for the cause of the National Board of Dental Examiners, and when that excellent work is functioning as the National Board of Medical Examiners is now operating, I will be ready to sing the *Nunc dimittis*.

I have been privileged to work with Banzhaf, Midgley, Barrett and others in the organization of the American Dental Educational Council. I have been honored by working with Weston Price, Tom Hinman, Clarence Grieves and Eugene Warner in the organization of the Research Commission. With Arthur Black and Ned Friesell, I was the founder of the American College of Dentists; and now with the men that the profession has set aside for that great work, I am again privileged to be a part in the organization of one of the greatest, if not the greatest, powers for good to the profession in the days to come, the National Board of Dental Examiners. Can a man ask more, and could he have the face to criticize a profession that has so signally given him the opportunity to do and make for himself a place in it? I ask only the privilege of doing for the dental profession what my hands may find to do, asking for nothing but the honor of so doing.

IMMEDIATE DUPLICATE DENTURE SERVICE*

By FRED D. MILLER, D.D.S., Altoona, Pa.

DURING the past ten years, twenty or more articles have appeared in our dental literature on the subject of immediate dentures. The A. D. A. Library service can supply a folder of these articles, and all of them contain many valuable suggestions for the construction of immediate dentures. I would suggest to those of you who have not yet rendered this very valuable service to your patients that you avail yourselves of the opportunity afforded by this excellent library service to read these fine articles and get all of the viewpoints of these men who have contributed so much to make your efforts and mine infinitely easier and more satisfactory to our patients. Personally, I do not think there is one sound argument against immediate dentures and only one against immediate duplicate dentures, and that is the cost of the duplicate to the patient. Surely in this day and age, the average business man or woman cannot afford to be without a duplicate denture. The arguments for the duplicate denture certainly offset the cost, and at no other time can the arrangement of the teeth be accomplished so satisfactorily as when they are set in the exact relation to the face that the natural teeth occupied, with, of course, such improvements in alinement as are deemed necessary and expedient. Even the selection of the tooth form and shade are greatly simplified, and, above all other considerations, the establishment of centric relation, the bugaboo of full denture construction, is eliminated, at least for the present.

For a good many years, when there came to my office to have a full upper and lower denture constructed, a patient who had the teeth removed previous to his visit to me, and had been going around without any teeth in the mouth for a period of six months or more, I have refused to construct dentures for him, simply because I did not care to assume the responsibility of this type of case; first, because it is just about the hardest thing in the world to get proper cooperation and the patient must wear the dentures to be satisfied with them. So, I have in a number of instances refused to construct cases for this type of patient, and I pass these cases on to some other dentist and let him have the worry and grief. Of course, you understand that I am not a denture specialist, but a general practitioner. The greatest satisfaction of immediate duplicate denture service is this: the patient is never without teeth, not for a minute, and he doesn't know what it is to go without them and he always wears them. He wouldn't think of going without his dentures. Sore places may develop from impingement or overextension, but the patient keeps the case in and comes to the office for adjustment, but never with the case in his pocket or pocketbook.

A number of years ago, I constructed

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

an immediate denture for a retired business man, and this case taught me a very valuable lesson. This man, a wealthy bachelor, was a good friend of mine. One day about three months after he had started wearing this full upper denture, a woman friend of his asked me why he did not wear his teeth. I said that I did not know that he was not wearing them, and she said that he took them out between meals. I called him on the 'phone and said that I wanted to see him. He came up to the office and of course he was wearing them when he arrived. I said, "Tom, why aren't you wearing your teeth all the time—do they hurt you?" He answered, "No, but they just get my goat." (Remember I said that he was retired, so he had lots of time to worry and fuss.) I asked him what was the longest time he had worn them continuously and he said about ten hours. I said, "Tom, you will never learn to wear dentures unless you keep them in for at least forty-eight hours—now I want you to promise me that you will go home and keep those teeth in for forty-eight hours and report back to me." He answered that he would do it if it killed him. Three days later, he came into my office and greeted me with the good news that he didn't know they were in his mouth—he was perfectly comfortable and used to them. This was a very valuable lesson to me. He had never given them a chance and I have told that story to every denture patient since and have never had one come back with his denture any place but where it should be—in the mouth. I pass this story on to you for what it may be worth—I know that it has helped me and many patients.

The first step in the construction of an immediate denture is a wax impression, in which will be placed the extracted teeth. Next, the removal of the first pulpless tooth, which is most important, because this one extraction will give the patient confidence in the dentist, a valuable asset and time saver in all future relations with that patient. After this extraction, the field of operation should be kept isolated with cotton rolls and the patient should not be permitted to wash out the mouth until a well-organized blood clot is established. The socket is then covered with dry foil (which is used to cover silicate fillings, the tongue being thus prevented from making suction on the socket and the clot being kept in place). Then the patient is carefully instructed to avoid any suction on that socket and to avoid the use of mouth washes, as the normal blood clot is nature's best means of protection to the tooth socket and the important factor in the healing of extraction wounds by primary intention. If there has been no reaction after extraction of a posterior pulpless tooth and the clot is well organized and there is no postoperative pain after a three-day interval, the next posterior pulpless tooth is removed and the sharp edges of the buccal process are removed with a rongeur and files if necessary.

If after another interval of a day or more, there has been no reaction, we may remove several posterior teeth and so proceed until all of the posterior teeth are removed, the six, seven or even eight anterior teeth remaining.

Photographs of teeth before and after extraction are valuable as records. Facial records (using the soft solder method) are secured and filed for future reference.

The next step is to secure an accurate impression. If the cost of duplicate dentures does not enter into consideration, we take a second impression from the cast and make two casts. During the time that we have been extracting the posterior teeth, we have selected the mold and shade, selected the teeth—two sets—

secured the impression of the lower teeth and made a cast. If the case is a full upper with natural lower teeth or a lower partial plate, the lower cast is mounted on the "balancer" and an upper biteplate is secured and the bite taken, there is no difficulty to secure centric relation with the natural anterior teeth in position. If there is to be any staining of the teeth, these markings are outlined on the one cast.

The upper cast is now mounted on the balancer and we are now ready to set up the teeth. If we have seven anterior teeth on the cast, we select the right central incisor and, with a plaster saw, the tooth is removed from the cast. With a vulcanite bur, the socket is prepared in the stone cast, care being taken that the tooth will go up into the socket at least one-eighth to three-sixteenths inch, this depending on the density of the bone. In degenerative bone, the tooth is set well up in the socket, care being observed that the tooth shall not impinge on either the labial plate or the septal bone.

Next, we cut the left lateral incisor off the cast, prepare the socket and set in exact alinement, with such improvements in inclination, relation, etc., as we may care to make. Next, the right cuspid, then from the left cuspid to the left central incisor, and finally the right lateral incisor and bicuspids are set up. With these anterior teeth set up in position, the posterior teeth are set up, so that the initial contact will be on the posterior teeth. In a marked overbite, it will be necessary to open the bite considerably, and as these cases will both ultimately be refitted into complete dentures, the set up of the posterior teeth is very important and the occlusion must be in good balance.

The duplicate denture is set up in exactly the same way. The two dentures are completed in vulcanite, without a labial rim, but with a post dam and such relief over any hard areas as may be deemed necessary. The cases are now completed in vulcanite and we are ready at the next appointment to remove the six, seven or eight remaining teeth and immediately insert the denture.

Under local anesthesia in our own office, the teeth are extracted, and before the patient is permitted to eject the fluid contents of the oral cavity in the receptacle, in other words, before the patient is permitted to "spit out," the denture is inserted and pressed firmly up into position and kept there for from five to ten minutes, i.e., until the bleeding has stopped and coagulation has taken place, because we do not want saliva to come in contact with the sockets. The patient is now permitted to relax and we hand him a mirror, saying, "They are all out, and they are all in." "Don't they look fine?" "But how funny they feel!" the patient may say. "Nobody would know I had them out, would they, doctor?" To which the reply: "No, indeed, and I do not want you even to allow your wife or friend or anyone else to see you without them. It is of the utmost importance that these teeth be not removed except for a few minutes to clean them and then they must be immediately replaced, because if they are left out, the sockets into which these teeth are inserted, will close up and you will not be able to get them in again without considerable discomfort." I have never had a patient come into the office with a full upper case of this type that was not in his mouth. If care has been exercised in the fitting of each tooth into its socket and the comfortable adjustment of the occlusion, he will have a minimum of inconvenience. It is advisable to have the patient return for adjustment about two or three hours after the teeth have been extracted and the immediate denture has been inserted. After the anesthesia

has worn off, any impingement can be adjusted by grinding, the case being removed, cleaned and replaced. If there is any difficulty in keeping it up, a little powder may be used.

I am sure you are all aware of the fact that a very large majority of denture patients, perhaps I should say the patients who wear "plates," are expert jugglers, and a great many people use powder all the time. This is all explained to the patient, with the assurance that its use is just a temporary aid until the case has settled into its proper position. Most patients do not need to use it after the first day or two, but it is of the utmost importance that all of these facts be explained to the patient before the teeth are removed, and he should be made fully aware of the fact that the masticating efficiency will be reduced 90 per cent and that he must not expect too much.

RERIMMING

Rerimming is accomplished by taking one denture and trimming it down all around to relieve all muscles. With a tracing stick of modeling compound the rim is placed on the entire periphery and tempered. The denture is placed in the mouth, and, with the teeth in central occlusion, the muscles are manipulated in exactly the same manner as any muscle-trimmed impression. The denture is then thoroughly chilled and a model run in stone and sent to the laboratory to have the necessary vulcanite added. The patient goes home with "a spare" in the mouth and consequently is never without teeth.

Of course, the only modern thing about this method is the improvement in technic. Since the advent of modeling compound, muscle-trimming technic, stone casts, improved teeth and modern laboratory service, the operation has become a comparatively simple procedure.

Victor H. Sears has explained his technic in an article, the chief advantage being the construction of a transparent celluloid base, which is sent with the patient to the exodontist. This transparent plate is fitted over the trimmed cast; which enables the operator to see just where it is necessary to trim the bone. I have used this method, but when a rim is not used, it is not necessary.

Dr. Jaffee, of Washington, D.C., has many valuable suggestions on immediate denture service. Dr. Campbell, of Kansas City, and many others have written on this subject.

Charles I. Stoloff, of New York City, has an article in *The Dental Digest* which explains his method of "Replacement with Artificial Teeth Immediately After Extraction." He constructs an entire case of temporary materials, sealing-wax and baseplate with an anterior rim, and while this method may do nicely in some emergency, I do not believe it practical or a safe procedure for patients to wear teeth that are fastened with sealing wax. Personally, I would not want to sleep with one in my mouth —not having the slightest desire to inhale a tooth.

CONCLUSION

The advantages of this technic are:

1. The patient is never embarrassed by being without teeth.

2. He learns to wear and handle dentures much more quickly and with less complaint than when he has become accustomed to going without teeth.

3. This is not a temporary denture: it is finally rerimmed or rebased and made into the denture which the patient will continue to wear. The duplicate case is treated in the same way. (I am fully aware of the fact that there is no such thing as a permanent mouth or denture.)

4. The patient always has a "spare" in the event of fracture or accident.

5. This method may be readily practiced by the general practitioner who will give some time and thought to occlusal balance and who would probably not practice alveolectomy.

6. Facial expression is not lost so readily and teeth are in their correct relation to the face. The esthetic phase of denture service is much simplified.

7. The postoperative healing of extraction wounds is greatly aided, because the salivary secretions are kept from the sockets, the normal blood clot is maintained and the denture acts as a matrix, giving form to the socket. Better ridges are the result.

PERIODONTIA AS BASED ON FACTS, NOT FADS, IN PRACTICE*

By HUNTER S. ALLEN, D.D.S., Birmingham, Ala.

THE hope of controlling periodontal lesions lies not in the treatment of advanced cases, but in the early diagnosis and correction of incipient forms. It is reasonable, therefore, to call attention to the point at which the greatest emphasis has been placed and to suggest a change of emphasis from suppositions to facts.

Our means of diagnosing periodontal diseases are more or less limited to certain symptoms which are to be found in the tissues affected. Sometimes, these symptoms are so striking that they compel attention in even a casual examination. Not infrequently, pronounced destruction has taken place in the tissue with but slight outward evidence. These cases often escape notice until irreparable damage has been done.

Periodontal infection like other human afflictions is the result of two conditions: one, the extrinsic, or local; the other, the intrinsic, or the resistance of the forces attacked. The attacking forces consist of various local irritants such as: (1) traumatic occlusion, food impaction and the presence of calculi and faulty fillings; (2) circulatory deposits such as of mercury and lead and phosphorus, and (3) bacterial invasion.

The result of these forces is determined by the strength of the attack and the resistance with which they are met. The second condition, tissue resistance, is also variable, being dependent on circulation, density and physiologic function of the local tissues, which are, in turn, affected by the general health and constitution of the individual.

In view of the wide range of symptoms which are manifest in the various forms of periodontal infection, it will be recognized that the adoption of a systematic method of examination is essential. In my practice, I have found the following classifications of tissue changes given us by Bunting to be exceedingly helpful: (1) change in color; (2) change in form; (3) change in density, and (4) change

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in the line of attachment, augmented by such local symptoms as loosening of the teeth and the presence of pus.

CHANGE IN COLOR

The appearance of healthy tissue varies in different persons from a light to a dark shade of pink, but the color is uniform throughout. This color, Bunting states, is the reflection of the hemoglobin in the capillaries which lie beneath the mucous membrane, the depth of color being determined by the quality and quantity of blood in the vessels. In a full-blooded person, the submucus blood vessels are filled with red blood, which gives color to the gum tissues. On the other hand, an anemic person will have less blood in the surface vessels and the hemoglobin content will be low and the color of the gums a very light shade of pink. By a consideration of gum color, we are able to understand many important facts about the general health of a patient.

CHANGE IN FORM

The gum contour in a normal mouth follows the contour of the edge of the enamel at the neck of the tooth, which it slightly overlaps. Deviations from this normal contour are of two types: (a) shrinkage, or retraction, and (b) swelling, or hypertrophy.

An example of the former is seen in the retraction resulting from toothbrush abrasion. Swelling of the tissues indicates an inflammatory reaction caused by some irritation, and usually signifies a good degree of resistance. When the tissues shrink on slight injury, resistance is usually low.

CHANGE IN DENSITY

In health, the gum tissues are hard and firm and able to resist mechanical injury. Soft and spongy gums are easily abraded and hemorrhage is often produced by ordinary mastication or very slight injury.

LINE OF ATTACHMENT

Probably the most certain method of diagnosing periodontal infection is careful exploration of the gingival crevices. Normally, the gum tissues are firmly attached about each tooth to the periodontal membrane at the bottom of a shallow gingival crevice. When this attachment is disturbed and a space exists between the root and the surrounding tissue, it is certain that the inner structures have been injured. There may be a swelling and inflammation, but as long as the line of attachment is normal, serious destruction has not occurred.

LOOSENING OF TEETH

When the disease has extended so that the teeth have become loosened in their sockets, the condition is usually serious and the possibility of successful treatment is doubtful. When there is only slight movement and by roentgen-ray examination it is shown that at least the apical half of the roots are still imbedded, there is often a chance of prolonging the life and usefulness of the tooth.

PRESENCE OF PUS

Pus is by no means an infallible means of diagnosing periodontal disease. As a matter of fact, many of its lesions have no purulent discharge. On the other hand, the presence of pus is sometimes an indication that the tissues are resisting, and treatment in these cases is usually successful.

ROENTGENOGRAMS

Too much dependence should not be placed in the roentgenogram in diagnosing pyorrhea. While it is always helpful in determining the extent of bone destruction, one may easily be misled. For

example, it is sometimes impossible to distinguish between an active and an inactive condition.

To determine whether a tooth is worth saving, the first step is to know to what extent the tooth is involved; with what type of tissue we are dealing, and the reaction that we may expect. A casual examination cannot determine this. Clinical evidence has often been neglected in favor of roentgenographic evidence. While on this subject of roentgenograms, I should like to say that there are pictures that are good, pictures that are bad and pictures that are indifferent. Unfortunately, there are those among us who merely place the film in the mouth and, from the looks of the picture, have the patient do a clog dance during the time of exposure. Needless to say, such pictures are worthless. To interpret a roentgenogram, one must know what to look for and what he sees and, by combining clinical and roentgenographic evidence, give it meaning. A picture should give us a distinct line showing the alveolar crest, lamina dura, periodontal membrane, cementum, dentin, enamel, pulp and alveolar process. Deviating from the normal, the picture should show atrophy or condensation.

Atrophy of the alveolar process occurs in one of two ways, running with the crest of the ridge or vertically, with the long axis of the tooth. Gottlieb classifies this as horizontal and vertical atrophy. When resorption occurs, the lost bone is replaced by granulated tissue. If the crest is the first to become resorbed, the condition is known as osteoclasia. It then progresses deeper into the bone, eventually becoming halisteresis. The progress will depend to a large extent on the type of bone; for instance, if the bone is of an osteoporotic type, or has enlarged trabicular spaces, the progress will be faster.

OCCLUSION

The concrete factors in articulation are: correct tooth form, proper number of teeth, right position of teeth in arches, and a faulty relationship of the arches to the head and face.

Correct tooth form not only includes the formation of the cusps, but the length of the root as well. Absence of teeth will allow others to tilt, producing interlocking cusps or drifting from the right position in the arches. The discussion of arch relationship brings up another point for consideration, that of heredity. In the event of cross-breeding or mixture of types, arch relationship is apt to become abnormal. Consider the pure breed of Eskimos, with their well-formed arches: by cross-breeding or interbreeding, they are likely to have irregularities. In cross-breeding of certain types of dogs, the Boston Bull was produced. In America, we are more or less a mongrel race, crossed and double-crossed with the tapering, square and ovoid types. This could account for many of the abnormal arches that we see in daily practice.

Abnormal arches do not allow the teeth to work as a unit; instead, they work individually. While it is function that builds support, it is also function that destroys it. Occlusal trauma, then, is the result of loss of balance between the forces of occlusion and the supporting structure.

TREATMENT OF PYORRHEA

The treatment of pyorrhea is not, as some practice it, instrumentation exclusively, but is a matter of knowing all the factors in the disease and of making changes that will prevent continued injury to the affected areas. Steps have been taken to standardize a technic that will be applicable to all types of this condition, but as some cases seem to be local

and others a local manifestation of some systemic disturbance, standardization seems impractical.

The methods of treating pyorrhea can be classified as the conservative, the radical and the conservative flap. Stillman, McCall and Merritt are leading practitioners who have had outstanding success with the conservative method; while Ward, McFarland, Crane and Kaplin recommend gingivectomy. Still others report satisfactory results from the flap operation. Each fellow thinks his method best, and rightly so. He undoubtedly has his reasons. Possibly he is incapable of performing the tedious curettement necessary in the conservative method. Perhaps his sense of sight is of greater value to him than his sense of touch. Be that as it may, there are certain facts that must be considered in any method if the result is to be satisfactory to dentist and to patient.

The Conservative Method.—This method, which requires a minimum amount of tissue destruction, consists of curettement of the root surface, the removal of all mechanical or pathologic irritants, the correction of systemic and local abnormality, suggestions to remedy any unbalance and instructions that will lead to a physiologically clean mouth.

Gingivectomy.—This method represents the other extreme, according to Black. After there is an actual break in the tissue, which apparently occurs about midway between the surface of the root and the bone, the tissue attached to the cementum is exposed to the fluids of the mouth, and it soon dies, leaving the cementum denuded. At the same time, the vitality of the cementum is lost as a result of the destruction of the cementoblasts which lie on its surface. It is comparable to a piece of necrosed bone which cannot be exfoliated, and remains as a constant irritant to the adjacent soft tissue. On these pathologic changes, the treatment which he (Black) advocated is based. It should be understood that practically all hope of reconstruction of the periodontal tissue to normal or of a reattachment to the cementum is gone forever.

The mouth should be brought into the healthiest condition possible several days prior to the operation. With everything in readiness, the area is sterilized with a solution of iodine followed by a solution of alcohol. Procaine is then administered. The operation consists of resecting the gingivae to the border of the alveolar process, trimming all particles of process that might act as a mechanical irritant and thus leaving the roots bare to the depth of the pocket. This denuded surface is then packed with surgical pack and allowed to remain intact for ten days to two weeks. To perform any type of surgical operation on patients who are diabetic or are potential bleeders is indeed a grave risk. This operation is indicated in cases that will not respond to less destructive procedure.

Conservative Flap Method.—This method, advocated by Kirkland, has been most successful when used with two alterations. The operation consists of separating the septal tissue to the base of the pocket, and retracting labially and lingually with periosteal retractors. The tissue is held back, and thus observation of the field is permitted. Root surfaces and the affected alveolus are curetted, all mechanical and pathologic irritants and all so-called granulated tissue being removed, the wound irrigated and the divided parts sutured, the wax dressing being allowed to remain for from three to five days. The changes that I suggest are: (1) omission of a suture, and (2) the substitution of a surgical pack for wax dressing.

I have noticed that, in many cases, the

suture would act as an irritant and, after about five days, the septal tissue would have the appearance as in a chronic case of Vincent's infection. I have had better results by replacing the tissue in its normal position, allowing a clot to form and protecting with a surgical pack.

VINCENT'S INFECTION

The various treatments recommended for Vincent's infection have certainly unlocked the doors of the drug store. I do not believe there is another disease having a larger variety of therapeutic agents used in conjunction with its treatment.

The etiologic agents given credit for this infection are the spirochetes and fusiform bacilli. There are other organisms associated with these that are more or less saphrophytic. These set up an irritation that enables the causative organisms to operate in a more destructive manner.

TREATMENT

The first step in the treatment of Vincent's infection is to remove the slough with a spray of peroxide, sodium perborate or tincture of green soap. This will enable the therapeutic agent selected to come in direct contact with the first line of offense. Application of cauterants, germicides, spirocheticides, astringents and antiseptics has been advocated next, for the seminecrotic area. I am partial to Churchill's iodine and a 10 per cent solution of silver nitrate. These combine to form silver iodide. On the next visit, metaphen or dye is used, care being taken not to allow the dyes to discolor the teeth.

In home treatment, the patient uses an oxidizing agent. If the ulcer does not show signs of healing, the second application of iodine and nitrate of silver should be made. Overuse of this combination is apt to create a chemical condition that will cause the patient great discomfort and inhibit the progress of recovery.

To raise the general resistance, prohibit the use of alcohol, tobacco, condiments, etc. Impress the patient with the importance of keeping the intestinal tract clear with mild saline cathartics. Instruct him to take mild exercise and plenty of rest.

After the acute condition has subsided, correct all irritating factors, such as the presence of food packs, overhanging margins or trauma and malposition of teeth.

DIET

The problem of diet is very complex. McCollum has shown that dental lesions as described by Howe in his experiments with scorbutic diet on monkeys were not so much the result of the lack of vitamin C as of the shortage of minerals. This deficiency in decalcification arises from the lack of sufficient phosphorus. The results of Hanke's work in Chicago on orange juice therapy were not due so much to the vitamin intake as to the phosphorus content of the orange juice.

It has never been proved by Hanke or Howe that a deficiency of vitamin C may predispose to or favor the production of caries. The experiment was too short. Nor has Mrs. Mellanby ever produced caries experimentally. Yet men in the profession continue to prescribe cut and dried diet, knowing little about the final outcome. I feel very much like a discusser on this subject who said: "If I tried to discuss the subject of diet, I feel that I would display only ignorance, therefore I shall leave that to the essayist."

There are a few things about diet that I am willing to accept; namely, that foods are classified as proteins, which build and repair; carbohydrates and fats, which furnish heat and energy; mineral salts, which maintain life and build bone

and teeth, and vitamins, which protect us from disease. These combine to furnish the thirty-eight elements required by the body, which are divided into the following: fatty acid (linolinic acid), 1; glucose, 1; amino-acid, 18; minerals, 12, and vitamins, 6.

They should be taken in amounts not to burden the body uselessly and maintaining a balance of 80 per cent base and 20 per cent acid; yet Lennox, in reporting his findings on three native tribes of Africa, brings out the fact that two of the tribes live on alkaline-forming foods, and the other on acid-forming foods, yet caries is practically unknown. One can readily see then that diet is an individual problem or a matter of body chemistry.

Humanity is composed of various types, the tall, the thin, the short, the fat, each representing a particular makeup or a different laboratory. If there is such a variation in the physical appearance of people, there surely is a difference in the internal structure, which puts a different light on the outcome of the intake.

Physiologists tell us that proteins that build and repair our bodies are changed to amino-acids by the digestive juices of the body, and are absorbed in the intestinal tract by the blood stream, to rebuild the tissue. They also tell us that carbohydrates are absorbed in the blood stream as glucose or blood sugar, and that fats are changed to fatty acids, arglycerol, and absorbed in the lacteals. If there is a deficiency of iodine, which composes 60 per cent of the thyroxin, the hormone of the thyroid gland, the whole internal structure is thrown out of balance. Associated with hyperthyroidism is the nervous gastro-intestinal, respiratory and genito-urinary disturbance. The assimilation is bady impaired. On the other hand, if there is a lack of hydrochloric acid in the stomach, proteins are not broken up to form amino-acid or there is a biliary disturbance, when lipase does not come in contact with fats, resulting in a deficiency of fatty acid or a pancreatic disturbance. This fatty acid being one of the most important fluids in the digestive tract, there is bound to be a deficiency of these substances, as no matter how much is given, they will remain deficient until the physical disturbance is corrected.

To be a successful dietitian one must first be a diagnostician. He must know the individual laboratory that he is dealing with, which information would include, of course, the age, sex, occupation, physical makeup, constitutional condition, environment, etc., if he is to determine just what is to be the outcome of the thirty-eight elements that were originally intended for health. To quote John Albert Marshall: "How illogical then, in fact, how unwarranted, are the efforts of those not sufficiently trained to medical science to attempt therapy of dietary prescription."

It is quite possible that patients are being done more harm than good. Let dietary prescriptions alone. Remember that the prescribing of a remedy is the duty of a physician. Cooperate with him in every way possible, but do not, in the words of Shakespeare, "assume a virtue, if you have it not."

A PRELIMINARY REPORT OF TESTS MADE TO DETERMINE THE PHYSICAL PROPERTIES AND CLINICAL VALUES OF GOLD AND PLATINUM FOIL*

By R. W. RULE, D.D.S., San Francisco, Calif.

THE cohesive properties of gold foil as related to its use as a dental filling material were introduced to the dental profession about eighty years ago. The results accomplished by its use in this manner were, in many respects, very satisfactory, and it became and continued the mainstay filling material until the introduction of silicate cements and the casting process for gold inlays.

The hardness of well-malleted pure gold foil is entirely satisfactory, indeed ideal, for fillings in many positions, but when the filling is subjected to more than ordinary stress, as in restoring badly abraded incisal edges or occlusal areas, the need for a filling material with a harder, more resistant wearing surface has been felt.

Many years ago, an effort was made to supply such a material by sweating together an ingot or bar of pure gold and one of platinum and rolling to the desired thinness, usually about No. 20 or No. 30 foil. This was cut into narrow strips, freshly annealed, and used in the same manner as heavy pure gold foil. The results were good, but the material was a little more troublesome and difficult to handle, and many operators would not be bothered with its use. In addition to this, in recent years, the great majority of those who have continued to use gold foil have given up the heavier foils in favor of the No. 4. As a result, about twenty years ago, the demand for platinumized gold foil ceased and its manufacture was discontinued.

To G. B. Baird, of Los Angeles, is to be given the credit for urging the manufacture of and stimulating the demand for the gold and platinum foil which is under consideration in this report.

To the manufacturer belongs the credit for devising a means of compounding the gold and platinum and preparing it in such a workable and satisfactory form. About two years ago, Dr. Baird persuaded the manufacturer to prepare this foil, which consists of a piece of platinum placed between two pieces of pure gold and rolled and beaten out to No. 4, i.e., 4 grains to the 4 inch square sheet. Thus prepared, with the platinum completely covered and the foil beaten out so thin, it becomes almost as easily workable as the pure gold foil, and retains the advantages of the old heavy gold and platinum foil, while losing its disadvantages.

Dr. Baird, having put the foil to the test himself, introduced it to a number of gold foil workers along the Pacific Coast and in other sections, and it has come into quite general use.

While its clinical use apparently produced a harder surface, more resistant to wear, and it was believed that fillings

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made from it would be tougher and less subject to stretch or flow under stress, it seemed highly desirable that some tests be made to determine its physical properties so that we might speak scientifically in regard to its hardness, etc., and its fitness for certain exacting conditions in the mouth.

Tests were undertaken with a view to determining the comparative hardness, density, cohesion and tensile strength of pure gold foil and gold and platinum foil. I desire to give credit here to Prof. John Shell for valuable assistance rendered in the carrying out of these tests.

A report on the tensile strength will have to be left to a later date as the time available did not permit of carrying the tests to completion. Malleted fillings of each material were made in cavities approximately 2 by 2.5 by 5 mm., which had been cut in the uncovered dentin of extracted molars.

Brinnell hardness tests were made of the materials as malleted in the cavities. Two pure gold fillings showed, respectively, a maximum hardness of 57 and 53, a minimum hardness of 38 and 42, and an average hardness of 49 and 46. Two gold and platinum fillings showed, respectively, a maximum hardness of 53 and 59, a minimum hardness of 46 and 55 and an average hardness of 50 and 57. Specific gravity tests of the pure gold showed, respectively, 16.4 and 15.5, and the gold and platinum both 17.8.

It was then decided to take each of these pieces and roll them out to a degree which would probably give the maximum hardness and density obtainable for the respective metals. Accordingly, the specimens were rolled out from an approximate thickness of 2.0 mm. to a thickness of 0.7 mm.

Specific gravity tests were made again, which gave the figures of 19.4 and 19.7 on the pure gold and 20.4 and 20.8 on the gold and platinum.

Brinnell hardness tests of the rolled specimens showed for the pure gold, respectively, a maximum hardness of 67 and 60, a minimum hardness of 61 and 58 and an average hardness of 64 and 59. The gold and platinum showed, respectively, a maximum hardness of 84 and 83, a minimum hardness of 77 and 78 and an average of 78 and 80.

In summarizing these figures, we have, then, in the pure gold specimens as malleted, an average specific gravity of 16.0, as compared to 17.8 in the gold and platinum specimens as malleted; and in the rolled specimens, an average of 19.5 as compared to 20.6. The difference in the specific gravity might well be accounted for by the platinum content of the heavier specimens, though whether entirely so it would doubtless be difficult to determine accurately.

In the hardness tests, the pure gold specimens as malleted show an average Brinnell hardness of 47 as compared to an average of 53 in the gold and platinum specimens; while the rolled specimens show an average of 61 in the pure gold as compared to 79 in the gold and platinum.

The Brinnell hardness tests were made using a 10 kg. weight on a one-sixteenth inch ball for thirty seconds and calculating the hardness numbers. The density determinations were obtained by comparing the weight in air and in water.

It is estimated that these figures are accurate to ± 0.3 in the density tests and to ± 2.0 in the hardness tests. The only figures that are available for comparison, to my knowledge, are those contained in a report on the physical properties of dental materials by R. L. Coleman, research associate, National Bureau of Standards.[1]

1. Coleman, R. L.: D. Cosmos, 69:1007 (Oct.) 1927.

This author gives the estimated density and Brinnell hardness of six pure gold fillings, made by six dentists in split steel molds. The density tests were made by calculating the volume from the linear measurements and dividing the weight by the volume. The Brinnell hardness tests were made with a one-sixteenth inch ball and a load of 6.4 kg. The figures on density range from 14.2 to 19.0, with an average of 17.1. The Brinnell hardness varied from 18 to 61, with an average of 46. These figures compare favorably with our figures on the pure gold malleted specimens. The averages are: density, 17.1, as compared to 16.0, and hardness, 46 as compared to 47.

CONCLUSIONS

On the basis of these tests, we may say that the gold and platinum foil which works as readily and as well as the average pure gold foil produces a definitely harder filling.

Uncompleted tests, to be reported on later, apparently show that the filling will be more resistant to wear and less subject to flow.

COMMENT

This material should prove a valuable asset in operative dentistry for certain types of work: (1) restoring of abraded incisal edges and occlusal surfaces, when the dentin has become exposed by wear and has begun to "cup"; (2) restoring the incisal portion of Class 4 cases in which the exposed portion labially may be faced with pure gold, on account of the color; (3) at the contact in Class 2 fillings, two or three pellets may be worked in where a specially hard contact is desired, and indeed this should be done in practically all cases.

It seems probable that if the entire occlusal portion of Class 2 fillings were made of the gold and platinum foil, a definitely smaller step could be used, thus conserving tooth structure and the strength of the tooth, this being of relatively greater importance in bicuspids and especially lower bicuspids. A more definite report will be made on this at a later date.

The color of this material is dull, lacking luster and richness, and in general is less favorable than that of pure gold. Therefore, it is not desirable, nor is there any advantage in using it in Class 3 and Class 5 fillings. In Class 3 fillings, where heavy stress will come on the lingual portion, this part may be built with the harder foil.

It may be used in Class 1 restorations and will produce a harder, more resistant surface, though well-malleted pure gold, even noncohesive, is entirely satisfactory for these, and, of course, the noncohesive gold can be worked much faster than the cohesive.

Care should be exercised in annealing this gold and platinum foil, since overannealing makes it harsh to work and tends to burn the gold and change the gold and platinum relation. With light annealing, one-thirty-second and one-sixteenth size pellets of this foil work very satisfactorily.

ADDENDUM[2]

Hartman[3] gives records of his experiments with pure gold filling materials and pure gold plate. His highest Brinnell readings are 75 and 77. This is considerably higher than other tests recorded, which range around 40-50, with a maximum of 61.

Since the writing of the report, further experiments have been carried on with specimens made in split steel die cavities.

2. Oct. 4, 1934.

3. Hartman, L. L.: Controlling Factors in Manipulation of Gold Foil, J.A.D.A., 21:816 (May) 1934.

Gold and platinum foils, put out by two different manufacturers, have been compared. Although the relative quantities of platinum in the foils are not known, one of them seems to have a higher platinum content than the other, for it finishes up with more of a platinum color and shows greater Brinnell hardness. The comparative hardness of the two products averages 78 and 99.

Investigations are still in progress and a full report will be made at a later date.

A SAFE TEMPORARY PARTIAL DENTURE

By A. LAURENCE DUNN, A.B., D.D.S., Santa Barbara, Calif.

ONE of the most treacherous kinds of appliances commonly fitted to the human mouth today is the temporary partial denture of the so-called butterfly type. This device is made to replace an anterior tooth by the immediate restoration technic and is generally constructed without clasps. The only aids in retention are its close adaptation to the gingival borders of the lingual surfaces of the teeth, an extremely slight adhesion to the tissues and the active use of an agile tongue.

The denture of that type shown in Figure 1 was swallowed by a patient in a neighboring town and pierced the esophagus, death ensuing.

The solution of the problem lies in creating sufficient retention to hold the appliance in place under all circumstances. By using the technic described below, this can be done even where there are no teeth missing to permit the usual type of clasping. Advantage is taken of the lingual embrasures in such a way that 20-gage wires fit into four of them to form what I have termed "embrasure hooks."

Assuming that the task at hand is the immediate replacement of the upper right central incisor, the first step is to make an accurate model of that arch. Any precise impression technic may be used and the model run in any good hard stone.

It may not be necessary in 1935 to state what is meant by "immediate replacement," and yet it may be wise to eliminate any possible confusion. The term means the making of a model before extraction, the conversion of that model into one that will practically duplicate conditions after extraction, by carving from it the tooth or teeth to be extracted, and the construction of a bridge or denture over the resulting model; then finally the extraction, and immediately thereafter the fitting to place of the appliance, which has possibly been made several days in advance.

At the first sitting, the impression of the one arch involved is taken and the correct mold and shade are selected. Next, from the model obtained from the impression, a duplicate model is made for study and record. Then, from the working model, the tooth to be replaced is cut, the gingival portion being trimmed back approximately 2 mm. and the socket portion slightly less. Next, the desired porcelain tooth is ground to fit and waxed to place from the lingual aspect.

Now retention is planned by determining where to place the embrasure hooks.

A suitable place for them is usually mesially and distally from either bicuspid, on each side, and, in the case involved, the first bicuspids have been chosen. An old No. 2 round bur is directed into these embrasures at an angle of 20 degrees with the horizontal as shown in Figure 2. The result is four holes in the model approximately 4 to 5 mm. deep. Next a piece of 20-gage round wire is shaped as shown in Figure 3 and fitted to slip to place, then waxed.

Two precautions must be taken at this point: first, the wires must definitely provide retention, and secondly they must not injure the gums. To hold the appliance in the mouth, the hooks must be long enough, which means that the holes in the model must be deep enough. If they prove to be too long on fitting the denture to the mouth, they can be cut, but not lengthened. Therefore, they should be made too long, and they will probably prove not to be.

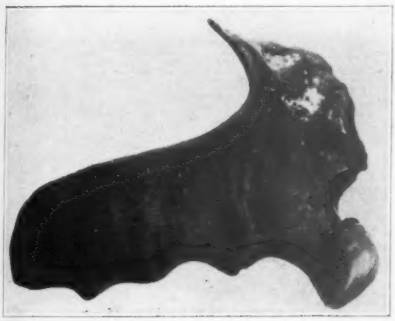

Fig. 1.—Unsafe type of partial denture (swallowed by patient).

The prevention of the second difficulty concerns the actual adaptation of the wire. It fits well into the holes, but loops freely above the gingival crests. In other words, it is adapted in contact with the model except where it crosses the gingiva, then rises 0.5 mm. above the gingiva and from that point drops inward to the bottom of each hole at a 20 degree angle. Eventually, in the mouth, it will ride freely above the gingiva and become secured just below the contact points in the lingual interproximal embrasures. In my earlier cases, I experienced trouble from having the wire in contact with the gum throughout, but, in making this slight elevation, I have completely eliminated cases of gum irritation.

Fig. 2.—First step in preparation of model.

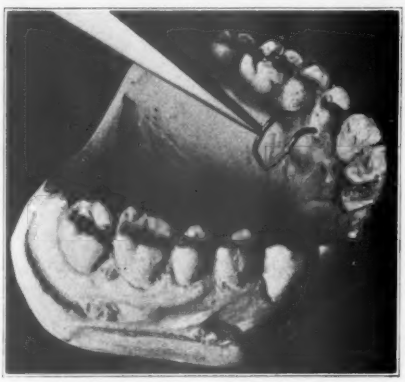

Fig. 3.—Adapting embrasure hooks to model.

Improperly used, these embrasure

hooks can do very definite damage, as can any dental remedy improperly used. Guard particularly against having unnecessary length after seating. This may cause any one of three ill-effects: It may exert pressure on the retaining teeth and result in orthodontic action; it may impinge on the gum and create gingival irritation; and, if the denture is worn for a prolonged period, it may tend to cause decay in susceptible teeth.

Note definitely that no teeth are cut in this technic. All of the preparation is made on the model.

From there on, there is the routine procedure of waxing up, flasking and vulcanizing. Figure 4 shows a model which represents the mouth with the denture fitted to place. Figure 5 shows the completed case.

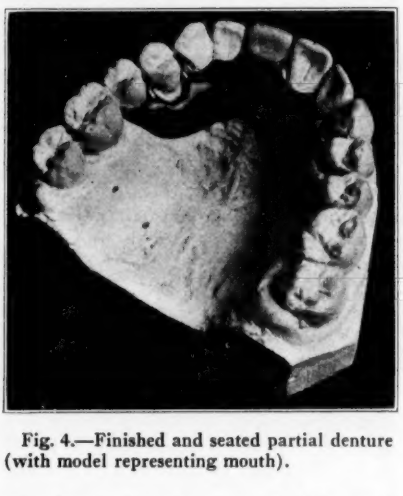

Fig. 4.—Finished and seated partial denture (with model representing mouth).

We are now ready for the extraction. Having the finished bridge at hand, we extract the tooth in question, slip the bridge to place, and, finding the porcelain fitting too snugly against the gingival portion of the gum, carefully grind it back until it fits as desired. We then test the embrasure hooks for overextension and cut them shorter if need be. If they have been made too short, in spite of all admonitions, we contour them toward each other, and some retention will be gained. The patient is asked to practice removal of the appliance. This may be aided by catching the most distal portion of the left (or right) side with the left (or right) fingernail and springing it loose while tilting downward from the front with a grip on the porcelain tooth.

The case is checked the following day. Before dismissing the patient, we explain that the denture will serve only the temporary purpose of spanning the space during the healing period and must be replaced, probably with a fixed bridge, within a certain specified time.

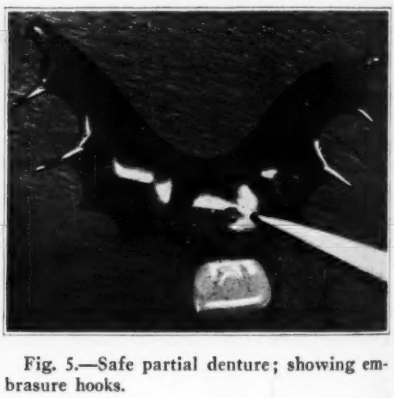

Fig. 5.—Safe partial denture; showing embrasure hooks.

The same principle of employing embrasure hooks can be utilized in other ways. With a tooth missing from one side of the arch, permitting the usual clasping of the teeth in that area, a single or double embrasure hook may be placed on the opposite side. Similarly, where there is an area of open contact through which a clasp may be slipped, the denture may be stabilized by using an embrasure

hook at some properly selected location.

Where the bite is found to be extremely close, I have obtained sufficient strength by having the cases made of gold, both cast and swaged. Ninety-five per cent of the cases can be handled successfully with vulcanite, because of the settling of the lingual gum, which we may safely anticipate.

There are many uses to which this type of retention device can be placed. It is a question in my mind whether we should use it in the class of work which we hopefully regard as being permanent except in rare cases. Rather, I believe its greater use comes in that class which we frankly classify as temporary, and here it can convert a dental appliance from an annoyance and risk into a safe restoration.

OPERATIVE PROCEDURES INCIDENT TO THE CONSTRUCTION OF THE CAST GOLD INLAY*

By ROBERT K. BROWN, D.D.S., M.S., Ann Arbor, Mich.

DENTISTRY of today should assume its rightful place among the professions that serve the health and welfare of mankind. The facility with which it will do this depends on the point of view and attitude of each member of the profession. During the last decade, dentistry has developed from a system of mechanical procedures to one which involves to some extent science, art and medicine. The operative dentist should master these three phases of his profession in order adequately to serve his clientele. The introduction of biochemistry and biophysics into the dental curriculum has given the recent dental graduate a biologic point of view which his predecessors lacked. This discussion has to do primarily with the biologic aspects of operative procedures, with special emphasis on those having to do with the gold inlay, but it is also related to any operative procedure that involves preventive or restorative work on teeth.

Dr. Hatton, of Northwestern University,[1] has given us a hypothesis that every operator should remember. He states that the uncovering of dentin will give a theoretical pulp exposure and that the larger the areas of dentin uncovered, the more dangerous this exposure becomes. In conjunction with this hypothesis, we may state another. U. G. Rickert, of the University of Michigan, has said that degenerating pulps under large fillings are a more dangerous source of infection than the foci resulting from devitalized teeth. The clinical operator could give us a third hypothesis closely related to that of Dr. Rickert; namely, that operative procedures, unless carefully and intelligently controlled, may cause the degeneration and death of a pulp from shock, thermal change or trauma, for he has observed this many times in his practice. The presence of the pulp is accepted, but the fact that it is a most favorable subject for degeneration is forgotten. It frequently fails to repair itself after degeneration

*Read before the Section on Operative Dentistry at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1935.

1. Hatton, E. H.: Pulp Pathology from Standpoint of Clinician, J.A.D.A., 17:2265 (Dec.) 1930.

starts because it has no protective tissue and lacks a collateral circulation. The pulp, encased, lacks the adaptability to volume change that is incident to inflammation; which prevents a return to normal from a hyperemic state. Hyperemia in other parts of the body helps to restore equilibrium, but this is not true of the pulp. Hyperemia of the pulp will produce a fibrosis of its tissue, but it is hard to demonstrate that thermal shock, accompanied by bacterial invasion, will cause pulp death. The most difficult condition the dentist is called on to diagnose is degeneration of pulps which give more or less vital reactions to all available tests. It is admitted that infected pulps exist in carious teeth and that thermal shock may be a deciding factor in degenerative developments.

Hartzell, Henrici and Price have shown that teeth with caries will show bacterial invasion in about 43 per cent of the cases; that positive cultures can be made from the pulps, and that this condition is present in periodontal lesions. These facts should not be alarming, as infected pulps do not all die, nor do they all show degenerative changes; but they are strong arguments for the proper handling of this vital tissue, so important to the patient's health and comfort.

I have reviewed the literature on the cast gold inlay for the last two years in an effort to ascertain the extent to which attention has been given these three hypotheses in articles published during this period the major subject of which was the cast gold inlay. I found that fourteen articles in all were published and that in only three of them reference was made to any procedures that would protect freshly cut dentin or reduce the likelihood of pulp degeneration. All of the other articles discussed the physical properties of the various materials used in the cast gold inlay technic and the procedures incident to the use of these materials in the actual construction of the inlay. THE JOURNAL published seven articles and in one of these very brief mention was made of the protection of the pulp. The *Dental Cosmos* published three articles, one of which mentioned the protection of the pulp, as follows: "Many a tooth is ruined and many cases of pulpitis are caused by pressure on the axial walls of the cavity, especially with the m.o.d. inlays." The *Dental Items of Interest* published two articles during this time and one mentioned the protection of the pulp, as follows: "In using the gold inlay several objectives are obtained. . . . It maintains the normal health of the dental pulp." The *Dental Digest* published two articles, both of which considered the gold inlay technic and materials.

With this evidence, it would appear that we have not recognized the fact that dentistry is really applied biology functioning through the possession of diagnostic and therapeutic ability, highly developed technical skill and the application of true artistic principles. The dentistry of the past was a science of the physical order; now, it is recognized also as being of the animate order with its source in biology, which deals with living organisms. Dentists who have mastered the technical aspects of restorative work have become absorbed in the mechanical procedures incident to this work and have frequently lost sight of the important result, the health service value of their work.

The mechanical procedures in the inlay technic have been developed to a place where they produce a satisfactory, dimensionally accurate inlay. Our essayists and clinicians have cooperated with the National Bureau of Standards to develop the gold inlay for the profession but they have relegated to the background a very important problem in its construc-

tion, that is, how to conserve the vitality of the healthy tissue with which they are working. Every dentist would be willing to sacrifice dimensional fit and even esthetic values in order to preserve the health of his own teeth, but he seems to lose sight of this fact when working on his patient.

Preventive dentistry of today is in the hands of the general practitioner; for it is by reparative measures, utilizing mechanical procedures coupled with biologic principles, that he will control the ravages of decay or oral disease. The use of the bite-wing roentgenogram with careful digital examination, employing sharp explorers, will enable us to discover caries in its initial stages and arrest its progress before any large amount of tooth destruction occurs. This is the operator's field in preventive dentistry, but beginning decay is frequently not treated by the dentist, who will say, "Let us leave these cavities until they become larger." This reasoning is fallacious. We are not caring for the patient's interests as we should because, as decay increases in magnitude, it becomes a greater and greater source of possible pulp degeneracy. We are not concerned at present with the preventive phase of operative procedures, but with reparative procedures which involve the use of simple or compound inlays as a means of arresting decay.

A careful diagnosis is made and a treatment plan evolved for the restoration under consideration. We must follow the outline of procedures in cavity preparation given to us by G. V. Black, but we must modernize them in the light of present knowledge, as Dr. Black would if he were alive today. There has been too much tooth destruction in the preparation of inlay cavities, and a study of outline form is indicated. The doctrine of extension for prevention has meant a great deal to the longevity of inlays, but, in following this doctrine, many of us are guilty of making cavities too extensive.

The labial or buccal and lingual margins of inlay cavities should be prepared to facilitate finishing the restoration in the mouth and to permit the excursion of food so that these margins will be self-cleansing and also may be cleaned by the toothbrush. The slicing of proximal surfaces in making inlay preparations frequently carries these margins beyond the requirement of extension for prevention and results in an unwarranted display of gold and an unnecessary amount of tooth destruction. The cervical margins should be carried under the free margins of the gum unless an abnormal recession of this tissue has occurred.

A recent article by W. L. Wylie[2] describes a study of the comparative amount of tooth substance destroyed in using the slice and box preparations. His conclusions were that (1) the slice preparation is slightly better than the box type because it destroys less tooth substance; (2) the greater extent of cavosurface margins in the slice preparation leads to a greater chance for mechanical imperfection in this vulnerable part of the restoration and increases the possibility of recurrence of decay, and (3) it could not be proved that the axial wall was closer to the pulp in the case of the box preparation than when the slice type was used. If the proximal surface to be restored is markedly convex, the approach to the pulp may be much closer in the slice type; which would indicate that the operator must have several types of cavity preparation available and use the type indicated for the case in hand. Markedly bell-shaped crowns of teeth are not

2. Wylie, W. L.: Comparative Study of Slice and Box Preparations, J.A.D.A., 21:1391 (Aug.) 1934.

adapted for the slice technic in establishing outline form.

In considering resistance and retention form in cavity preparation for inlays, it is necessary to take into account a certain depth of preparation. In a Class II type cavity, in which two surfaces are involved, we have been prone to cut large dovetails to secure an extreme occlusal interlocking. This will result sooner or later in periodontal disease through excessive buccolingual leverage during mastication. Such faulty interdigitation is produced either through the formation of an excessively deep occlusal fossa in a mouth with comparatively little occlusal wear or by an attempt to produce a young occlusal form in a middle-aged or older person who has worn the teeth down to a considerable degree. We should prepare the occlusal interlockings, or dovetails, in one of two ways: (1) wide from buccal to lingual and shallow from occlusal to pulpal aspect or (2) narrow from buccal to lingual and deep from occlusal to pulpal aspect. The procedure is governed by the formation of the occlusal surface of the tooth, its abrasion and the age of the patient. The dovetail must be interlocking on both buccal and lingual portions; that is, it must be bilateral, for if it is unilateral, a torsional strain may eventually dislodge the filling. The other requirements of resistance and retention form will be secured by flat seats on the pulpal and cervical floors if an adequate occlusal interlocking and properly tapered cavity walls are secured.

The convenience form in the cavity will be taken care of by the taper used in its preparation, for the cavity must be of the hopper type, that is, larger at the occlusal than at the cervical aspect. An inlay should present walls tapered at least 8 per cent per inch, as this facilitates the withdrawal of the impression or the wax, as the case may be, and aids in securing a dimensional fit.

In discussing the removal of carious dentin, which is the next step in cavity preparation, let us consider procedures that will enable us to protect the pulp and any exposed dentin to the fullest degree from mechanical and thermal injury. H. W. Gillett[3] has stated that dentists should be constantly striving to safeguard the normal health of the tooth pulp and that pulps of teeth that have received operative treatment will be less likely to present subsequent menacing changes from normality if the chances for infection from exposed dentin are kept at a minimum during operations and if precautions are adopted to reduce to a minimum the liability to chronic thermal shock.

The dentist today is using stones and various types of disks moistened with mouth temperature water in order to lessen the frictional heat developed during the cutting process. This precludes the use of the rubber dam unless the dam is applied after the cavity has been outlined by both disks and stones. It is interesting to note that Dr. Taggart,[4] in 1907, in describing his method for making gold inlays, remarked that " no steel tool should be used in the preparation of cavities," and that "carborundum stones of suitable size and shape are preferable." The operator of today is becoming accustomed to the use of efficient stones and his clinical experience has proved that patients suffer less pain in cavity preparation with this means of cutting, especially in the enamel, than if burs are used. The factor of economy is rather important,

3. Gillett, H. W.: Relation of Cavity Preparation and Inlay Form to Tooth Pulp Health and Comfort, D. Items Int., 55:519 (July) 1933.

4. Taggart, W. H.: New and Accurate Method of Making Gold Inlays, D. Cosmos, 49:1117 (Nov.) 1907.

for we know that stones are less expensive to use than burs because of their longer life. C. F. Bödecker has given a detailed description of the proper use of stones and burs in cavity preparation. In using stones or burs, it is advisable to employ a lateral motion with the bur or stone parallel to the pulp and not cause pressure to be exerted toward the pulp. The lateral pressure should be intermittent and the smaller sizes of burs and stones are preferable to the larger. Stones should be kept running true by means of stone dressers, such as a diamond point mounted in a metal handle. By using small burs or stones with intermittent pressure in a lateral direction to the pulp, revolving at high speeds, frictional heat and its sequelae are reduced to a minimum, and if one knows the sensitive areas of the tooth, cavity preparation can be accomplished with little discomfort to the patient.

The possibility of frictional heat searing the dentinal tubules and even burning the pulp itself is ever present. Burs that have become clogged with moist débris tend to generate a great amount of frictional heat, and a rubber dam that will insure a dry operating field should be used to counteract this tendency. Stones, if not kept moist with water, are also a prolific source of frictional heat irritation. When burs are used, the blades should be staggered and not parallel, as parallel blades cause a chattering noise and vibration in cutting and also tend to produce grooved cavity walls because the blades follow the same path.

The final finishing of all margins is done with abrasive rather than steel instruments. This lessens the possibility of loose or fractured enamel rods remaining on the cavosurface angle and does not affect the intercementing substance of the rods, as does the vibration of the spiral leaves on the burs or the planing effect of hand instruments.

It is possible to prepare an inlay cavity today without the use of a local anesthetic and still cause the patient little discomfort. In fact, when a local anesthetic is used, we frequently operate at too great a speed, causing hyperemia of of the pulp, which is often followed by pulpitis and the institution in this vital tissue of degenerative changes with their disastrous sequelae. A local anesthetic should be used with great care by the operator. It possesses disadvantages that frequently overshadow the advantages incident to its use. It is a valuable asset, if used by the careful operator, allowing him to do more accurate work without causing pain to the patient.

The dentist who has taken all possible precautions to prevent injury to the pulp during operative procedures now faces the problem of protecting freshly cut dentinal tubules from any source of irritation, chemical, thermal or mechanical. Dentinal tubules shrink from irritation such as abrasion, decay, operative procedures or trauma, and may become permeable as far as the original confines of the pulp chamber. It is essential that they be sealed and a varnish is the best means available at present, although all the cavity varnishes, or liners, that are on the market today admit of improvement if they are to serve their purpose. Mr. O. T. Zimmerman, working in the laboratories of the Dental School at the University of Michigan, tested eight commercial cavity liners under conditions simulating those present in the mouth. These tests were of the accelerated aging type and accomplished in a few hours or days what it would normally take several months or years to accomplish in the mouth.[5] Films were made by spreading samples of varnish on glass slides and

5. Bödecker, C. F.: Treatment of Sensitive Teeth, D. Cosmos, 70:893 (Sept.) 1928.

were tested by immersion in (*a*) water, (*b*) one-third hydrochloric acid and (*c*) 5 per cent sodium hydroxide. Then an electrical diffusion test was made by taking glass tubes filled with a salt solution, each end of the tube sealed with filter paper impregnated with the varnish to be tested and glued with Canada balsam, immersing them in salt solution and applying a current of 125 volts. This test showed two things: (1) the permeability of the film and (2) the time at which a complete breakdown occurred. Several films did not permit diffusion. All films showed a complete breakdown, whether they showed diffusion or not. One cavity liner, which was composed of synthetic resins, was markedly superior to the other seven products, six of which were cellulose derivatives and the seventh a solution of guttapercha in chloroform. Hence, it would appear that the choice of cavity liners is limited. After a cavity has been prepared, a cement base should be used wherever indicated, but before the cavity is based, the dentinal surfaces should be sterilized with 95 per cent phenol, followed by 70 per cent alcohol and then varnished to protect the tubules from the acid action of the cement.

Dr. Gillett[3] has stated that the conductivity of pure gold is about 600 times that of cement and that of gold alloys used in inlay work is considerably less, probably about one-half that of pure gold when compared with cement. It is imperative that the operator balance the relative masses of gold and cement so that the extent of surface directly exposed to thermal influences through the metal during any period of exposure to heat or cold is kept at a minimum.

The Bureau of Standards made some tests for Dr. Gillett which proved the value of an interposed layer of cement between a gold casting and the dentin of a tooth. An inlay resting on the dentin will show a temperature rise of 27 degrees F. in five seconds when it is subjected to a change of temperature from 68 to 122 F., which is about the upper temperature tolerance of sound teeth. The tests were conducted so that a time temperature curve could be made.

When a one-sixteenth inch layer of cement was interposed between the inlay and dentin, it took seven times as long over the same temperature change for the same temperature rise (27 F.) to occur. A one-eighth inch layer of cement took eighteen times as long. The initial rise in temperature was almost instantaneous when no cement was present; with one-sixteenth of an inch of cement, it took a second or more to be detected, and with one-eighth of an inch of cement, it took ten seconds. If the tooth was subjected to a temperature of 122 F. for one and two-tenths seconds only and then subjected immediately to 68 F., the inlay resting on dentin showed an instantaneous rise in temperature and a quick drop. When the one-sixteenth inch layer of cement was interposed, the rise was ten times slower, with a correspondingly slow drop, and when the one-eighth inch layer of cement was used, the rise and drop were negligible. This proves the importance of interposing as much cement as possible between metal fillings and the pulp or sensitive walls of a tooth. A healthy tooth will tolerate heat at 130 F. with less discomfort than it will cold at 40 F., for the earliest manifestation of irritation to the pulp is intolerance of low temperatures. This is proved clinically by the fact that the tongue, cheeks or lips will attempt to protect a tooth containing a filling when it is subjected to irritation from cold.

Many operators feel that the dehydration caused by using alcohol is dangerous,

but this is a question that our therapeutists should decide. The too rapid or continuous application of air that is too hot or cold in drying a cavity will cause an irritation that may be dangerous to the pulp. After the dentin has been sterilized, the cavity liner, or varnish, should be applied and hardened by the intermittent use of the warm air syringe over a period of about two minutes. It is advisable to use measures for the protection of the pulp if the cavity encroaches on any recessional lines of the pulp or on the main body of the pulp itself. After these protective measures, varnish may be applied. It is important to prevent the spread of varnish over the cavosurface margins of the cavity as this will result in the development of a film of varnish that will be dissolved by oral secretions in a short time and cause a leaky margin around the inlay. The use of silver nitrate in deep-seated cavities is to be recommended if it does not cause pulp irritation. Dr. Rickert's technic for using ammoniacal silver solution, which is reduced quickly by an essential oil such as eugenol, will cause the minimum amount of irritation and be as efficient as any other method of quick reduction. These measures will tend to protect the dentin and insulate it against thermal, chemical or electrical disturbances from extraneous sources; which is very important when any metallic restoration is used, as dentin is especially sensitive to even the slight variations of temperature that are constantly present in every mouth. The fact that exposed dentin has been varnished before an impression of the cavity is secured will prevent the forcing of infective material into the permeable tubules by the pressure exerted in securing the impression. The varnish will also protect the dentin while the temporary filling is in position, for this type of filling frequently permits the ingress of moisture and acts as a piston, driving it into the dentin and causing pain.

It is important that cavities when finally prepared be as shallow as possible and yet give retention and resistance form to the inlay so that it will be permanent and will function satisfactorily. The inlay that must be driven to place in the tooth has no place in restorative work today. The binding, irritating effect on the dentin will cause a pulp irritation that may be dangerous. It is far better to allow room for cement, and, to secure this, many operators cut away gold from the cavity portion of the inlay casting on the pulpal and axial walls. This relieves the binding and gives protection to the vital tissue of the dentin. The use of gold of sufficient thickness to withstand the impact of opposing teeth without changing form, and the distribution of strength in the cavity to satisfy resistance and retention form when the inlay is cemented are always necessary. No advantage is gained by deepening the cavity or by adding to the mass of gold beyond these requirements. The hollow gold inlay, as described by A. M. Goldenberg,[6] has a clinical value in many cases which require extensive loss of tooth substance, as it possesses a central body in the casting built of the cementing medium, which decreases thermal shock to a marked degree owing to the nonconductivity of such a large bulk of cement, and has adequate retention to be a permanent restoration.

The type of gold used for inlays has been under debate for a number of years. The Bureau of Standards has classified the golds available for dental purposes and Marcus L. Ward is making an extensive study of these golds to determine the desirable physical properties and the effects of heat treatment. He feels that

6. Goldenberg, A. M.: Hollow Gold Inlays, J.A.D.A., 21:1205 (July) 1934.

the property of percentage of elongation, or the percentage which a given specimen of metal increases in length between the conditions of no load and rupture, and the property of proportional limit in pounds per square inch are the most important properties of inlay golds. The hardness of the material, or its resistance to penetration by an external object, is not so important as was formerly believed. For the average inlay prepared with the box type of cavity, a gold should be selected from the group of soft inlay golds (Type A). For such inlays as three-quarter crowns or those of the veneer and slice type, or when abnormal stresses are likely to occur during mastication, a gold should be selected from the medium group (Type B).

It is not the purpose of this paper to discuss the selection of golds further than to state that excessive trauma may result if too hard a gold is used, affecting both the tooth and its investing tissues supporting the inlay and the opposing tooth or teeth and their investing tissues occluding and articulating with it. Heat treatment is of little value with the individual inlay when the soft type of golds is used, but it is recommended when the medium type is used if it is specified by the manufacturer of the gold. The gold content of alloys used for casting is constantly being decreased, and the more the gold content is decreased, the more necessary it becomes to heat treat the alloy. The heat treatment that it is easiest to use is a bath of glycerine, stearine, cotton seed oil, castor oil or crisco or any other similar cooking oil. The only equipment necessary is a reliable thermometer, a covered cup or pan for the liquids, and a small gas burner. The oil must be changed frequently and not overheated. The manufacturer of the gold used should give the temperature and the time necessary to temper the gold alloy. The casting should be quenched or plunged into cold water as soon as the button turns black after the casting process has been completed. This leaves the metal soft and easy to work. The casting is pickled and adjusted to the model or in the tooth, the final finishing operations are completed and all final adjustments made. The casting is then tempered for the particular alloy used.

We have discussed so far the value of early detection of caries and the correction of this condition and any structural defects in the tooth. The application of a modified extension for prevention in cavity preparation has been covered, and a plea has been made for the utmost care to protect freshly cut dentinal tubules when working on exposed dentin. The protection of the pulp from frictional heat during cavity preparation has been discussed, and the care to be used when operating under a local anesthetic in order not to endanger the life of the pulp by thermal shock or mechanical injury as a result of working at excessive and sustained speed. As a final part of this thesis, we will consider the requirements which the finished filling should meet in order to enable its receptor, the tooth, to function normally in a state of continued health, and be a source of comfort to the patient.

The anatomic restoration of lost tooth substance by the inlay must be carefully studied. It is not a mechanical procedure, following no definite plan, but must be individual for each case. The first step in the procedure of placing the cast gold inlay in the tooth involves the adjustment of the contact point. This contact must be as nearly ideal for the tooth under treatment as possible. Environment and inheritance may affect the ideal, but often we can improve on nature at this point in our technic. The contact point of anterior teeth should be

like the contact formed by placing two marbles together and should be near the lingual embrasure. In the posterior teeth, the contact surface is about 1.5 to 2 mm. buccolingually and slightly less occlusogingivally, and is placed near the buccal embrasure. Interproximal wear will call for a narrow contact from occlusal to gingival aspect and wide from buccal to lingual to replace this loss of tooth substance. Separation may be used to help relieve this condition as well as that found when teeth have drifted together owing to caries.

Loss of contact or inadequacy of contact is the most common cause of impaction of food substance into the interproximal space, with a consequent degeneration and absorption of the supporting tissues of the tooth. Pockets will form and pyorrheic conditions will be set up, with even a possible rarefying osteitis and caries of the subjacent bone. Previous to this, there is the continual danger of fermentation of these food masses and early recurrent decay of the proximal surfaces of the affected teeth.

The restoration must function in centric occlusal balance and also in eccentric occlusal balance, as this helps to prevent traumatic occlusion, which is a great source of trouble. An inlay should be so adjusted that the patient will admit that he does not notice its presence in the tooth. After centric and eccentric occlusion are established, the proper contour of each cusp should be secured. Isadore Hirschfield, of New York City, has said[7]:

> There is a tendency on the part of some operators to cause an extensive flaring out of the cusps in the buccal or lingual direction that causes marked occlusal leverage with a morsel of food as a medium. This should be considered especially in the treatment of teeth that are already deprived of their alveolar support. Indeed, from the periodontist's viewpoint, it seems advisable in such cases to bring the occlusal height of contour of the cusp nearer the mesiodistal axis of the tooth than its original normal position. The reduction of leverage by proper placing of the cusps is very important for the health of the supporting tissues and also from the point of view of possible traumatic injury to the pulp.

7. Personal communication to the author.

The marginal ridge should be placed at the same height as the ridge of the proximating tooth, and deflecting grooves should be cut in the inlay to divert food to the buccal and lingual aspect of the contact point, thus protecting the interproximal tissues. This can be accomplished efficiently with a bur and engine, but is neglected by many operators. Each posterior inlay should present deflecting grooves, and this phase of the procedure should be developed as a habit. Other important grooves and fossae should be reproduced, but not overaccentuated, as they are necessary for the efficient mastication of food, simulating those in the other teeth of the patient.

All fillings should be finished with an even continuity of tooth surface. Many inlays present rough margins that facilitate recurrence of caries. Grinding of the margins may be started on the indirect model of the cavity, but must be finished on the tooth by the use of disks and abrasives. Frictional heat generated by the final polishing of the inlay has caused many an active hyperemia of the pulp, and the dentist must be careful not to irritate the pulp during this final step of inlay work. This condition is most likely to occur when the direct inlay technic has been followed.

The actual technical construction of the inlay has progressed to a point where dimensionally fitting inlays may be secured by any operator using any one of several technics that are available.

Greater accuracy has been secured in the construction of the indirect model by using electrodeposition of copper, a distinct improvement over the amalgam model accruing. The copper plating technic has been simplified so that it is both economical and dimensionally accurate, and the model possesses a greater edge strength than one made of amalgam. Inlay waxes now have physical properties that enable the operator to secure patterns with the minimum risk of distortion, and the new high heat expanding investments give castings that compensate for the shrinkage of the cast gold to a satisfactory degree for clinical purposes. The materials used should comply with their respective specifications as given by the American Dental Association.

This paper has merely touched on the technical aspects of inlay work, for, as stated in the introduction, they have outstripped the biologic and physiologic phases in the literature. These phases are very important and should be discussed by the profession in an attempt to improve their status in the inlay technic of today. They involve the personal equation of the individual operator. Certain definite principles must be followed by every dentist in restorative work and these principles hold true for any restoration, no matter what the filling may be. This allows the artistic sense and ability of the operator full play and esthetics and physiologic function will go hand in hand to produce a restoration which is all that its name implies.

W. H. O. McGehee[8] has given us a creed to live up to if we are to be considered a professional success.

1. We must be deeply grounded in science and must possess the scientific mind and professional spirit.

2. We must be close observers of phenomena and good diagnosticians.

3. We must recognize the bearings of oral conditions on the general health and well-being.

4. We must intelligently exercise the functions of an oral physician.

5. We must be skilled and efficient technicians, sincere artists, humanitarians and cultured gentlemen, with highly developed moral instincts and attributes.

I should like to refer to a recent article of Arthur T. Rowe[9] which shows how the biologic point of view has been developed owing to the marked changes in dentistry today which have emerged from a series of unrelated events. It was instituted first by the development of oral radiography and followed by the Taggart casting process. Hunter's challenge to dentistry made us aware of our responsibilities in health service, and the researches of Billings and Rosenow set up a challenge that was a great stimulation to research. The Carnegie Survey of dental education, which pointed out discrepancies in our educational system as it was then organized, was the last marked influence on our profession. The other events demonstrated the deleterious effects of many accepted operative procedures and provided means of doing work that was biologically and physiologically sound. As a result, operative procedures are changing and we need sound training in the biologic and physiologic sciences and their application to clinical teaching. With this eventuality, we shall be worthy of being classed as health servants and not as mechanics, for we will have restored the efficiency of teeth as a part of the masticatory unit, and, while doing so, we will have pre-

8. McGehee, W. H. O.: Text-Book of Operative Dentistry, Philadelphia: P. Blakiston's Son and Co., 1930.

9. Rowe, A. T.: Present Trends in Operative Procedure and Their Possible Influence on Dental Education, J.A.D.A., 22:30 (Jan.) 1935.

vented degenerative changes in the pulp and in other vital tissues of the mouth which might have later become foci of infection with deleterious effect on the health of the patient.

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DENTAL PHASES OF ORTHOPEDIC SURGERY*

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IN attempting to reach a common ground for the discussion of the problems of the oldest of medical specialties, dentistry, and one of the more recent special fields of surgery, orthopedic surgery, it is essential that the scope of each group be understood. Dentistry, probably one of the most clearly defined phases of medical practice, dates back many generations, even centuries. Its development parallel to, but more or less independent of, medicine has resulted in the formation of the great profession of dentistry and its recognition throughout all lands. Its many great achievements need no review here. To the lay mind, its chief concerns are the teeth, their development, preservation and functional restoration. Too frequently, the layman, and possibly some members of the profession, fail to recognize the common relation that anatomy, physiology, physiologic chemistry, growth, heredity and nutrition bears to dentistry and medicine alike.

Orthopedic surgery, one of the more recent specialties of medicine, is defined as "that branch of surgery especially concerned with the preservation and restoration of the functions of the skeletal system, its articulations and associated structures"; in short, bone and joint surgery. The term orthopedic, coined by the great surgeon Paré, is derived from *orthos,* meaning straight, and *paedios,* meaning child. Thus, the straightening of children and the present scope of the specialty came by its name. It is vitally concerned with the problems of growth, metabolism, physiology, physiologic chemistry, nutrition, heredity, etc., especially in their relation to the development and function of the skeletal framework of the body. The fundamentals of both dentistry and orthopedic surgery are the same, coinciding especially in the phases of growth and calcium metabolism.

It would be presumptuous for any orthopedic surgeon to pretend to discuss dental conditions, as he sees them, from any other than the surgical point of view. His knowledge in relation to teeth is meager. His observations in the field of bone and joint surgery may be of help when shared with the dental profession, for they bear on many of the problems of calcium and phosphorus metabolism, as well as on growth and infection.

Any surgical procedure is accompanied by more or less damage to normal tissue in the course of the correction of a pathologic condition. Skin must be divided, muscles separated, blood vessels ligated, etc. A wound with lowered local resistance is deliberately produced. Such an area invites localization of infection

*Read before the Section on Medical Relations at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 21, 1935.

from foci elsewhere in the body. It is reasonable to assume that any localized infection may extend to remote parts, affecting areas of lowered resistance. This principle is recognized relative to skin infections, such as furuncles and carbuncles, various ulcerations, middle ear infection and acute throat infections, but it is overlooked in its relation to less acute infective processes of the mouth, nose and throat.

Surgical procedures of election should be carried out only after all the possible sources of infection are reduced to a minimum. This means wholehearted cooperation with the dentist and oral surgeon, employing their skill in eliminating infection from about the teeth and jaws. The sinuses and tonsils are viewed in the same light.

The possibility of the aspiration of infectious material during the course of general anesthesia must not be overlooked. It is good surgical practice to put the mouth in good condition prior to major operative procedure. Infections should be eliminated and sufficient time for healing permitted to lapse.

At the Children's Memorial Hospital, all orthopedic cases admitted for surgical operation are carefully examined from the medical and dental angles and all recommendations are carried out before the patient is submitted to operation. Extraction of infected teeth and the elimination of sinus and tonsillar infection take precedence over all surgical work except when the emergency is great. A dental chart is made out for each patient admitted. The examination and recommendations are recorded. The examining physician and the dentist cooperate in deciding the course of action. The patient may be admitted to the ward for dental care only, and then discharged and readmitted at a later date for the orthopedic procedure.

Following strict adherence to this routine, postanesthetic complications and secondary wound infections have been eliminated. The dentist is a most valuable member of the surgical staff.

The pendulum of interest in focal infection has now swung in the direction of ultraconservatism in relation to dental infection. Undoubtedly, many teeth have been sacrificed without benefit in arthritis, but that fact does not justify the assumption that teeth are never the key to the infectious process. In orthopedic surgery, the accurate diagnosis of irritative lesions of the joints is essential. A tooth with an active or chronic sinus should be eliminated by extraction as soon as the local condition permits. This is especially true in those cases wherein tuberculous infections may be ruled out by negative tuberculin tests. The results following extraction in irritative joints in children are spectacular. In adults, the subsequent course is liable to be less favorable.

The incidence of caries in tuberculosis, spastic paralysis and arthritis in children is high and suggests impaired normal development early in fetal life. Clara M. Davis has made extensive observations along these lines on the orthopedic cases at the Children's Memorial Hospital, and will present her findings in the near future.

Lateral curvature of the spine presents one of the major problems in orthopedic surgery. It may result from many conditions, such as infantile paralysis, unequal length of the legs and defective development of the vertebrae. That such curves increase most rapidly during the period of rapid growth, especially during adolescence, is a common observation. Treatment consists of correction of the curve and retention in apparatus or by spine fusion. Observations made by R. E. Heupel, dentist in attendance at the

Children's Memorial Hospital, on a long series of cases of scoliosis undergoing correction and operation, revealed that many of these cases showed a stunting or delay in development of the mandible, with resulting malocclusion. At first, this was thought to be due to pressure on the lower jaw by the corrective cast. Observation subsequently showed that this defect was present in untreated cases and was a manifestation of impaired growth and an integral part of the clinical picture. This observation is of great value in differentiating the element of impaired growth as a causative factor in scoliosis.

The contributions of the dental profession in the field of calcium and phosphorus metabolism have been outstanding. They are invaluable to the orthopedic surgeon, for he sees an unending variety of cases which reflect altered deposition of mineral salts in the skeleton. A brief review of some of the more important clinical phases of bone disease may be of interest.

The normal response of bone to increased stress and strain is the increase of the mineral elements deposited in the cortex and trabeculae. The strength and functional efficiency are increased. The converse follows disuse or diminishing of function, the cortex and trabeculae rapidly losing their calcium and other mineral components. The bone of a paralyzed extremity, or one immobilized by rest in bed or by retention in apparatus, is poorly fitted for the strain of weight bearing and active use. Fractures are not uncommon during this period. Under normal conditions, calcification increases and, with it, rigidity and strength.

The bone-forming cell may reveal inherent defects which prevent normal response to growth and functional hypertrophy. In the dwarf, the cartilage of the epiphyseal line fails to differentiate and develop into normal bone. The skeleton is short. The normal stimulus for bone growth is absent. A growth hormone is inactive or absent. In Morquio's disease, the epiphyseal cartilage is present, but all regularity of growth is lost. In fragilitas ossium, growth takes place, but the mature bone cell fails to respond to stress and strain. The bones are fragile and break with insignificant trauma, but heal promptly. Gross deformities occur as a result of the many fractures. The tendency to brittleness diminishes at puberty. Agenesis of any part of the skeleton may follow defective growth of the primative segment or limb bud. Overgrowth of any part of the skeleton may occur or the part be duplicated by division of the primative bud.

Calcification and growth are influenced by an increase or decrease of the circulation. If the circulation is increased by the presence of anomalous vessels or by short circuiting of arterial blood into the venous system, overgrowth takes place. If the circulation is restricted, growth is impaired and calcification is diminished. When the circulation is absent, bone death occurs (aseptic necrosis). Avascular bone becomes dense (infarction), later separating from living bone and becoming a sequestrum, which is absorbed or is replaced by new bone. Increased circulation which results from inflammation causes local loss of calcium.

In infectious processes involving bone, increase of calcification or decalcification may occur, depending on the organism and the reaction of the host. In tuberculosis, decalcification is the rule in the acute stage and calcification in the healing stage.

In the pyogenic infections, as in osteomyelitis, decalcification of the involved portion and calcification of the adjacent bone occur.

Gonorrheal infections reveal marked decalcification. Syphilitic changes are

most variable. Excessive periosteal bone formation associated with epiphyseal defects is present in the congenital type and destructive lesions in the later stages.

Disturbances of calcium fixation are found in many of the general metabolic disturbances. In rickets, which is attributed to a deficiency in vitamin D, there is a delay in the differentiation of the epiphyseal cartilage in its transformation into mature bone. This results in the nodular thickening at the ends of the long bones and of the ribs. There is also a failure of calcium fixation in bone proper. The bones are flexible and unable to withstand strain, yielding readily, marked deformity resulting.

In hyperparathyroidism, there is a loss of calcium in nonosseous structures. Fracture is common. This condition presumably results from an overactivity of the parathyroid glands, which loosens the bone calcium bond in skeletal tissues.

Osteomalacia, or softening of bone, is rather an all-inclusive term, indicating a prolonged calcium loss which is probably due to a failure of calcium absorption rather than to deficient fixation.

Arteriosclerosis may be classed under metabolic disturbances. It is usually present in late adult life, but may occur in childhood. In the advanced stages, calcification of the vessel walls is demonstrable.

Arthritis, whether due to infection or disturbed metabolism, presents three distinct pictures of calcium changes as revealed by the roentgenogram. In the rheumatoid form, which occurs in young adults, decalcification is marked. In osteo-arthritis, increased bone growth and spur formation are marked. In the combined form, evidence of loss and fixation of calcium may coexist.

The formation of bone tumors is closely allied to bone formation and destruction and necessarily to the problems of calcification. The benign osteoma, chondroma and multiple exostoses represent tumors that rarely become malignant. They are evidence of irregular direction and degree of bone growth and ossification. Myositis ossificans may be generalized as local. The changing of muscle to bone does not represent a true tumor, but shows a very abnormal calcium disturbance.

The giant-cell sarcoma is border line in its relation to malignancy. It is characterized by bone destruction and decalcification. Sections reveal many giant cells. True metastasis has not been definitely established.

The malignant tumors involving bone are divided into primary tumors, arising from bone structures, and secondary tumors, arising elsewhere and metastasizing to bone. Of the primary tumors, osteogenic sarcoma is most common. New bone forms in the tumor mass. Metastasis to the lungs is early. In osteolytic sarcoma, bone destruction is marked and metastasis is early. Multiple myelomas arise from the myeloid elements. Bone destruction and decalcification are marked. The lesions are multiple. In endothelioma, calcification is quite marked.

Probably the most marked calcification occurs in the ossifying meningioma. The secondary tumors from the breast, stomach and intestines, and the metastatic lesions from hypernephroma and chloroma show marked decalcification.

CONCLUSIONS

1. The fundamental problems of dentistry and orthopedic surgery are the same in many respects.

2. The interchange of experience of workers in these respective fields should be mutually beneficial.

3. The gap separating the practice of these specialties should be narrowed for the benefit of humanity.

INDICATIONS, CONTRAINDICATIONS AND TECHNIC IN THE TREATMENT OF INFECTED DECIDUOUS ROOT CANALS*

By JOHN E. GURLEY, D.D.S., San Francisco, Calif.

IN the opening paragraphs of his latest book, "Food and Health," H. C. Sherman makes this significant statement:

In our understanding of the processes of life, perhaps the three greatest advances of the hundred years have been, first, the establishment of the general principle of evolution with the subsequent working out of something of its genetic "mechanism"; second, the discovery of the widespread existence and activities of bacteria and the development of the theory of infectious disease and the science and techniques of sanitation; third and last, the development, which, for convenience, we refer to as the newer knowledge of nutrition and of the nutritional characteristics of foods.

These three statements become at once the foundation upon which we have built and will build. Through the first is yet to be developed a better understanding of the forces of heredity, and through the third, a better understanding of environment, as far as food is a part of our environment. Through the second, we have been forced and will be forced, in the treatment of disease, to come to a better understanding of life and life processes, biologically speaking. In fact, Sherman further suggests that there are two divisions of scientific insight, those dealing with "the structure of matter" and those dealing with "the processes of life."

Both of these apply to the healing professions and, with a thorough grounding of their implications and ramifications as far as dental service is concerned, will mean much in the way of prevention and, concomitantly, better living.

While dentists, or in fact any other group in any other field, may be more involved in specific procedures, the ultimate of such procedure must contribute to a greater good—in case of the healing professions, therefore, to better living, which means prevention of disease.

We are, for the moment, concerned with the treatment of infected deciduous teeth. The solution of that question is based upon Sherman's second corollary, but the ultimate outcome of such treatments must be better living for our patients, even to the point of prevention of infections.

We are treating teeth, immediately for the restoration of the normal and for comfort; but ultimately, we must have in mind their elimination.

Our plea, then, in our discussion today, is twofold: to cure disease as we find it and to develop principles which will lead to prevention. In other words, the treatment of infected deciduous teeth becomes a means to an end, and not an end in itself.

Twenty-five years ago, dentistry was purely mechanical. It is true that certain

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scientific courses were included in its study, but the teacher of such a course was frowned on by the technician or the dental mechanic, and so people were treated by removal of teeth, filling of cavities and insertion of crowns, bridges and dentures, but with little thought of scientific relations. What of the patient?

In 1912, or thereabouts, the focal infection theory was foisted on medicine and dentistry, and dentistry was quite turned about. We were forced to determine our position, and to place our work upon a scientific basis. Along with this too, the mechanics of dentistry developed into an art, so that today we may well say that dentistry has passed from the field of mechanics into that of art, but stands upon a scientific foundation.

Now these two terms "science" and "art," require some consideration. Science may be defined by one word, "knowledge." Art likewise may be defined by one word, "judgment." Science is the study of effects; art is the application of knowledge. So, through science, we determine, first, the effects of abnormal (pathologic) conditions in human tissue, and, secondly, the effects of means, of whatever kind, of alleviation of these abnormal conditions, that bring about a return to normal or effect a cure.

In discussing the treatment and conditions under which infected deciduous root canals may be treated, it will be necessary first to know just what we have to deal with.

Next, we must divide these conditions into those which can and those which cannot be treated. Finally, we will study the art and science of treatment. At the outset, may it be suggested that any attempt at complete standardization of methods, or of agents, should not be attempted, for in such an attempt, we become empiric, with sacrifices of both science and art. This does not disqualify either method or agent which might be a "specific" in any given disease; e.g., mercury in the treatment of syphilis.

INFECTED DECIDUOUS TEETH

Did it ever occur to you that, in most of our work, we are dealing with infections? The carious area is an area of infection, the inorganic content having been dissolved out, leaving the organic matrix to be attacked by saprophytic (pus-producing) organisms. Most infections in deciduous teeth come within the scope of alveolar abscesses and, in the majority of instances, have become infected through the previously infected organic content of the dentin.

Occasionally, a pulp may be infected from the apical end, through infection carried to it by the blood stream or perhaps the lymphatics, from some other point as a focus; or, as the attachment of the investing tissues is broken, infection may enter gingivally, forming, first, a lateral abscess, eventually involving the pulp and developing into an alveolar abscess.

The lateral abscess can be dismissed with the suggestion that, when treatment can be accomplished, the pulp is either infected or must be destroyed and removed and the root canals filled, the technic of which will be considered presently. Our chief concern is with the alveolar abscess.

PATHOLOGY

An alveolar abscess is "an area of infection, localized in the apical region of the peridental membrane, originating, in the majority of cases, in a preexisting infection in the canal or canals of the corresponding tooth, and, in a few instances, from a previously infected apical area of a neighboring peridental membrane."[1]

1. Endelman, Julio, and Wagner, A. F.: General and Dental Pathology, St. Louis; C. V. Mosby Co., 1920.

It is circumscribed, presents definite clinical symptoms and may be either acute or chronic. In the acute form, polymorphonuclear leukocytes are in the majority, while, in the chronic stage, "connective tissue of repair" (fibroblasts), plasma cells and mononuclear leukocytes prevail. It is important to remember that the source of infection is, in the majority of cases, within the root canal. The decomposed pulp, the contents of the pulp chamber and the canals, is now the end-product of organic decomposition. The pulp has been changed into various other types of proteins, amino compounds, including ammonia and hydrogen sulphide gases. In fact, the liberation of ammonia gas is a measure of the autolytic process.

CLINICAL SYMPTOMS

Tenderness to percussion; pain, tenderness, swelling and redness of gum, verging on purple; looseness and protrusion of the tooth, and, in many cases, increased temperature, constipation, fetor of the breath, malaise and headache are the clinical symptoms.

BACTERIOLOGY

Many studies have been made of pulpless teeth, abscesses, etc., with some variation in results. Probably, the following list of bacteria in these cases will be nearly correct: *Streptococcus viridans, Staphylococcus aureus* and *albus,* alpha prime and beta type streptococci and gram negative and positive bacilli.[2]

This consideration of the alveolar abscess applies to permanent and deciduous teeth as well. There is this difference regarding the tooth roots and the investing tissues. In the child mouth, after 4 years of age, we have the physiologic condition of root and alveolar process resorption, proceeding toward final exfoliation of the tooth. In case of an alveolar abscess, then, on a deciduous tooth, we have a different condition from that which obtains about a permanent tooth. In the case of a child under 4 or 5 years, with a deciduous molar involved, the condition may be much the same as that of a permanent tooth, and a granuloma may develop.

CASES IN WHICH TREATMENT IS CONTRAINDICATED

The warning previously sounded concerning standardization is here repeated. Let it be emphasized in our minds that standardization is not to be encouraged to too great an extent, for, in the treatment of disease or diseased parts, judgment, based upon knowledge, must have full play. We must use our science and our art. There are instances in which a certain treatment may be "specific," but this is not standardization. Therefore, no set rule can be stated as to when a tooth may or may not be treated, though, as a general statement, the following suggestions may be made as to contraindications for treatment:

1. Alveolar abscess, with granuloma present and a free flow of pus into the pulp chamber in a child under 5 years of age.
2. A carious floor of the pulp chamber.
3. In later childhood, roots three-fourths or more resorbed (though occasionally these will respond). The occlusion here needs to be completely studied.
4. Ill-health of the child. Under this heading may come consideration of heart conditions. The question may well be asked: Do infected teeth affect the heart, or does an affected heart affect the teeth? I believe that a faulty heart or circulatory system is first responsible for defective teeth, for, in all heart cases submitted, the defective tooth condition was extensive. Of course, the teeth may ultimately

2. Appleton, J. L. T., Jr.: Bacterial Infection, Ed. 2, Philadelphia: Lea & Febiger, 1933.

affect the heart, and we then have a vicious cycle. We have found these classes of patients with heart involvement:

(*a*) Those in whom extraction is indicated. The tooth or teeth, directly or indirectly, are a focus of infection. Regardless of cause or effect, the tooth has become a contributing cause.

(*b*) Those in whom extraction is not allowed. The patient may not withstand the surgical shock and the oral conditions are probably not the cause.

(*c*) Those in whom it makes no apparent difference. The tooth, then, we may treat and fill.

5. The child who is nonresistant to infections. These cases may not respond well to treatment.

6. Those patients suffering from dietary deficiencies. Possibly the two items just named might come directly or indirectly under this head. Experiments by Rinehart and Mettier, of the University of California, and studied further by Stimson, of the U. S. Public Health Service, link rheumatic heart lesions with vitamin C deficiency. Although these experiments have been carried out on guinea-pigs, and not on human beings, the idea is there for consideration at least. Always the child's health must be taken into consideration in connection with dental infections.[3]

7. Those having excessive caries, it being mechanically impossible to restore the teeth.

8. Those showing extreme loss of investing tissues.

INDICATIONS

Conditions in which treatment is indicated are as follows:

1. Gangrenous pulp, either partial or complete.

2. Alveolar abscess and no granuloma, with or without fistula.

3. Absence of a permanent successor. Furthermore teeth should be treated because (and most patients fall within this group)

(*a*) The deciduous teeth are the precursors of the permanent set, and are necessary for the child's development through mastication and enunciation and esthetically.

(*b*) They are the only space-maintainers. They fulfil nature's plan.

(*c*) No artificial retainer can assist in proper vertical development.

(*d*) Treating teeth develops the full scientific knowledge of the operator.

(*e*) Extraction allows setting of bone and soft tissue, so as to retard eruption of the permanent successor.

(*f*) The child thus retains his complete masticatory apparatus.

(*g*) Root canal treatment is easier on the child than extraction.

(*h*) As dentists, it is ours to prevent and to cure, not to tear down and build up. By saving the teeth, we prevent malocclusion; by curing, we become "doctors."

(*i*) Dentistry is mechanical, artistic and scientific. These three characteristics have full play in root canal therapy.

TECHNIC AND PHARMACOLOGY OF TREATMENT

1. *Differential Diagnosis.*—Differentiation must be made between the alveolar and the lateral abscess. In the former, the swelling is at, or near, the apical ends of the roots; in the latter, it extends well up into the margin of the gums, with considerable apparent detachment.

2. *Technic.*—In case of pain to the child, it will probably be best to pick our way through the decayed dentin, thus opening the pulp chamber, allowing the gaseous products of decomposition to

3. Science Weekly, Vol. 80, No. 2084, p. 12.

escape and permitting further drainage. This can be closed with a tampon of cotton and allowed to rest twenty-four hours, after which treatment can be initiated. (A disinfectant should be sealed in, if possible.)

As soon as possible, the pulp chamber is opened wide, the orifices of the canals being exposed. The chamber is washed with warm water, or warm salt solution, then dried and a cotton pellet saturated with formocresol is sealed into the tooth. This must be either changed or replaced at the end of twenty-four hours. Clinical symptoms (color change from dark blue to light red), and odor (if formalin odor predominates, we need no more; if gangrenous pulp odor predominates, we must repeat) will indicate the procedure. Usually, a second treatment will be required, after which beechwood creosote may be placed. This is allowed to remain a few days, then removed, the chamber and canal contents are cleared and a final application of chlorothymol is sealed in. After a few days, this may be removed and the canals dried and filled.

One definite rule may be stated: Do not enter the canals of deciduous teeth with an unprotected canal cleanser. The roots are short and may be open on the inside.

3. *Pharmacology.*—Formalin is a powerful disinfectant, but it is a sure one, and doubly so because it is a gas, and will thus reach the uttermost parts of the canal. But we must use it—do not let it use us. If we leave it in the tooth not longer than twenty-four hours, we will be well within the limits of safety. Care must always be exercised not to overtreat or to injure with strong drugs.

Formocresol may be prepared by one's druggist and renewed quite often. We must always be sure that our drugs are fresh. (The formula is: beechwood creosote, 5 c.c.; formaldehyde, 40 per cent, 3 c.c.; absolute alcohol, 2 c.c.) Cresol may be substituted for creosote. In fact, I have both. It is a modification of the formula in the U. S. Pharmacopeia.

While using the formocresol, we need to consider the case as an emergency, but, when through with this drug, we have plenty of time. Formalin precipitates proteins in a manner not unlike the precipitation of egg albumin when heated. It will, under proper conditions, react with ammonia to form hexamine. Therefore, it will have this tendency within the tooth and the gaseous end-products may thus be reduced. If allowed to remain too long, and in excess over diseased proteins, it destroys healthy protein beyond the apex; hence, the need for care. This is chemistry, and the law of definite proportion is definitely applicable. The cresol, or creosote, though possessing bactericidal properties, is a vehicle for the formalin. Alcohol, with some disinfectant properties, merely clears the solution.

Creosote possesses anesthetic properties and is a mild disinfectant. It is a coagulant like phenol, but, unlike phenol, the coagulated serum does not interfere with its disinfectant action. Care should be exercised to select clear, colorless creosote, so that the tooth will not become discolored.

Chlorothymol, a mixture of chloral hydrate and thymol, was introduced by Grove, and has a very useful place in the treatment of infections. The formula is: chlorol hydrate and thymol, equal parts, with sufficient alcohol to keep liquid.

Thymol as a disinfectant has a phenol co-efficient of 25.[4] It is a powerful disinfectant, both as a liquid and through vapor given off. It easily penetrates the tubuli and thus carries its action into the deeper parts.

Chloral hydrate, a hypnotic pharma-

4. Clark, A. J.: Applied Pharmacology, Philadelphia: P. Blakiston's Son & Co., 1932.

cologically, is used in this case as a vehicle for thymol. The function of alcohol is that of solvent and it has additional vehicular properties.

THE CANAL FILLING

In root-canal fillings for deciduous teeth, there is a rule which must be universally adopted: Use only such filling as will disappear as the root resorbs. Thus, guttapercha points and paraffin are eliminated. Many pastes have been submitted, and any one may be used. I have always used the following and have found it satisfactory:

Zinx oxide	15.00
Xeroform	5.00
Phenol	30 drops
Glycerine	add q.s. to make paste

TECHNIC

Isolate the tooth, preferably with cotton rolls, held by the nurse, and dry the canals with cotton-covered canal cleansers, following with a blast of warm air. Place a ball of paste in the pulp chamber with a blade burnisher, and tease it into the orifices of the canals with a smooth instrument. Take a small piece of baseplate wax, warm, roll into a ball and place on top of the paste. Then, with the No. 2 amalgam plugger, exert pressure, forcing it into the canals. Burnish off the excess, cover with cement and place the filling.

Always, in the treatment of infected root canals of deciduous teeth, we must have clearly in mind: (1) elimination of the infection and (2) restoration of tooth function.

It is my experience that generally these infections respond readily to treatment. We have the advantage of the growing process in the child, with a greatly reduced confinement of infection, due to the normal process of resorption and later exfoliation.

In the restoration of a tooth or teeth to function, we are maintaining nature's mechanism. Care must be given to approximating teeth and investing tissues, as well as to those in the antagonizing arch. By so doing, we have made a real contribution to the practice of prevention. We have also fulfilled the second of our two requirements: we have cured the disease. We have applied our science, through our art, both in the operation itself and in maintaining nature's mechanism. Our work is both an end in itself and a means to an end: prevention.

CARDIAC DISEASES AND THE DENTIST*

By BAYARD HOLMES, M.D., Chicago, Ill.

IN order for the dentist to more easily comprehend such a wide field as heart disease, I am dividing cardiac diseases into two distinct forms which only slightly overlap, namely, rheumatic and degenerative. By rheumatic carditis, we mean infection of the heart valves, heart muscle and pericardium, which is most frequently caused by rheumatic fever; which, in turn, is considered by most investigators to be a result of infection originating in the mouth and nose. Included in this source are dental conditions which have infection as their base. Rheu-

*Read before the Section on Medical Relations at the Seventy-First Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1935.

matic carditis is a disease of children, adolescents and young adults.

The other outstanding form of heart disease is most easily described as the degenerative type and, in contradistinction to the first form, a disease seen in middle or later life. Here, the progressive heart change is not based so clearly on infection, but is a part of the changing process of which we are all necessarily victims, or due to the strenuous life of our modern civilization, together with the many habits of eating that we are inclined to fall into. In the latter group, we can include the heart changes that are produced as the result of arteriosclerosis, diabetes, chronic interstitial nephritis, toxic goiter and syphilis.

In rheumatic carditis, the dentist should be particularly interested in what he can do to assist the physician in the matter of prophylaxis. As you have been doing in the past, you can continue to do; that is, educate the parents to the necessity of caring for a child's permanent teeth, and especially the too frequent neglect of the first and second molars. The care of the teeth in adolescence, from the prophylactic point of view, is perhaps not so important except when the dentist comes in contact with a young person who has had an injury to one or more of the valves of the heart, and in whose mouth there is present a low grade infection, which physician and dentist realize should be eliminated. Many of you fear to extract teeth for patients with leaky hearts. The point that I wish especially to emphasize is that, under these conditions, you are dealing with a young person, who probably still has a strong heart muscle, capable of withstanding the added work caused by the valvular incompetency and easily withstanding the shock of such added strain as gas anesthesia or local nerve block, or even extraction under ethyl chloride.

The physician referring a heart case to the dentist for extraction should give him a diagnosis and assist him in the choice of anesthesia, and particularly is this true in one form of valvular disease, namely, mitral stenosis, a disease predominating among young adult females. Here, the mitral valve has been diminished as to the size of its opening into the left ventricle, sometimes the opening of the valve being only a slit or hole through which the end of the index finger can barely be passed. Sudden death in the chair of the exodontist, due to this condition, has not been infrequent in Chicago. The cause of death is really formation of a clot in the left auricle and blocking of the mitral valve opening, or the passing on of this clot to some critical area in the external circulation; all as the result of the dilatation of the left auricle because the heart beats at so rapid a rate that not sufficient blood can pass through the narrowed mitral valve and therefore dams back and stretches the auricle where the clot begins to form.

There is another condition of adolescents and young adults in which the physician should especially cooperate with the exodontist. If a valve has been more or less injured in childhood, owing to rheumatism or some other infectious disease, there is liable to develop at a later period a reinfection of this damaged valve, usually by a streptococcus which has gained entrance to the circulation through the upper respiratory tract or mouth. This condition, which is called subacute endocarditis, gives rise to weeks and months of illness, in which fever, loss of weight, diminished appetite and frequently repeated showers of infected clots fly off from the valve to distant parts of the body. During the course of this often fatal disease, the physician may deem it necessary to make an effort to increase the resistance of the patient and

diminish the absorption of infective material from the mouth by having a dental consultation. In this circumstance, the heart muscle is usually competent, but here a new element of danger develops in the loss of resistance to infection, and I therefore suggest that as little traumatism as possible be produced by the dental procedure indicated. Although I may be somewhat prejudiced, I have a conviction based on several disastrous cases that the injury to the tissues, which are already reduced in their resistance to infection and by the anemia which is a common feature in these cases, may be a contraindication to the use of injection anesthesias, even including nerve block. Much as I realize that there are many arguments to the contrary, I feel that the inconvenience to the operator, the possibility of pain to the patient and the inability to accomplish so neat an extraction are counterbalanced by the greater safety to the patient in the end-result.

Turning now to the degenerative diseases of adult and later life, we face a different problem, as the only infection is that called focal, which rarely produces injury to the valves of the heart, but by slow processes reduces to the vanishing point the capacity of the heart muscle itself. The association of focal infection with degenerative heart muscle weakness or chronic myocarditis, as it is called, may be of considerable importance in isolated cases, but, to my mind, the necessary procedures of the dentist in caring for the teeth as a routine in a patient concerning whose general condition he is unaware may be just as important, as here there is no relationship with his family physician. The patient himself may not know that he has high blood pressure, albumin or sugar in the urine or perhaps the early symptoms of angina pectoris. Prophylactic measures, such as treatment of pyorrhea and faulty bite will rarely demand much inquiry as to the patient's general condition, but when multiple or even single extractions are to be performed on a man or woman over 45 years of age, the operator runs a considerable risk in the use of nitrous oxide gas, a local anesthetic and especially solutions containing epinephrine. There are two forms of hypertension, the one probably best understood by you being that resulting from the gradual lessening of the elasticity of the arteries, due to arteriosclerosis; but there has come to the consciousness of the medical profession in recent years a condition known as spasm of the arterial walls as a result of vasomotor nerve stimulation. This, a result of our civilization, is exemplified most clearly in the high tension business man of today, laboring under the added economic burden arising from the depression.

The latter condition leads me to digress from my preceding discussions, and I am doing it hesitatingly, but at the request of many members of your Society. There has appeared to be almost an epidemic of coronary artery disease, which, sad to say, has invaded the ranks of physicians and dentists. A fear of heart disease, a neurosis, in our professions would seem to be likely, so I will try to briefly reassure you. Before publication of an article by James B. Herrick of Chicago, in 1912, the condition known as coronary thrombosis was not recognized, except by pathologists, as a frequent cause of sudden death. The medical profession in the last ten years has become very conscious of this condition, and since it has a fairly clear-cut clinical course, the diagnosis has been made with greater and greater frequency, while the necropsy tables have not shown anywhere near the same increase. It is true that this is a disease associated with urban life and it has perhaps had some increase owing to the economic situation. The

following case illustrates what clinicians are encountering, with seemingly more frequency.

S. was the only son of parents who lived to the ages of 77 and 70. He was born on a farm, where he helped with the chores and attended grade school. By his sixteenth year, he had become independent of his parents and was working at a heavy trade with long hours, followed by study in the night. At 30, he had become a business man in a large city and, by close application to his work, obtained a position in the financial world by his fiftieth year. This necessitated the most strenuous type of brain work; namely, the merging of big corporations. In November, 1930, when he was 58 years old, he and his two partners were carrying out a so-called "big deal," when one of the partners died suddenly of coronary thrombosis, which, of course, imposed greater burdens on the two remaining partners. In the middle of December, the other partner died suddenly of coronary thrombosis. Thus again, there was an added strain on S., and between Christmas and New Year's, he suffered an attack of coronary thrombosis, which, fortunately, was not sufficiently extensive to cause death. With absolute rest in bed for three months, the collapse of his financial towers and a most exemplary life since, he is today a man of 65, who is obliged to use taxicabs for even the shortest city excursions, can do no stair climbing whatsoever, lunches on buttermilk and retires at 9 o'clock.

This case with its attendant catastrophies was not a coincidence. It exemplifies how mental stimulation accompanied by overeating and loss of sleep can keep the heart keyed up till something breaks in the complicated machinery. There were, of course, individual factors in each case and probably these differed in each person. We must realize that, in addition, there were some organic changes that had been developing for years and which determined the point of break. Thus, clinical observers feel that the chief cause of coronary thrombosis is a combination of hard work and long hours in childhood and a strenuous business life in the city, with its heavy lunches, club banquets and Sunday golf. It is thought that the stimulation through the vasomotor nervous system has kept the heart spurred on during times when it should be resting, and that it furthermore causes a constriction of the walls of the blood vessels, which results in increased blood pressure and thus again demands extra work of the heart muscle. As the coronary arteries distribute the strength-giving blood to the heart muscle itself, they bear the brunt of the work and therefore appear to be so frequently the site of thrombosis.

The profession of dentistry requires an indoor business life with a moderate amount of responsibility, but not so much as is laid on the business man, unless he has outside interests of such a character as meddling in the stock exchange. So I believe that if we do not overeat and will develop some hobby to distract our minds from our professions; if we swim or golf moderately, not all day Sunday with none during the week, and have a periodical health check-up once a year, our professions can dismiss the fear of coronary disease. Let the watchword of the future be, "Moderation in all things."

REPORT OF THE RESEARCH COMMISSION OF THE AMERICAN DENTAL ASSOCIATION*

TO the Officers, Board of Trustees and House of Delegates of the American Dental Association:

At the annual meeting of the American Dental Association held in St. Paul, Minn., Aug. 6-10, 1934, an appropriation in the amount of $11,500 was given to the Research Commission to cover grants and administrative expenses for the fiscal year beginning July 1, 1934 and ending June 30, 1935. In October, 1934, the Board of Trustees appropriated an additional $1,200, and again June 2, 1935, they appropriated an additional $300, making a total of $13,000 appropriated to the Research Commission.

The Research Commission allocated this fund as follows:

1. American Dental Association Research Fellowship at the National Bureau of Standards	$10,300
2. University of Louisville	750
3. New York Institute of Clinical Oral Pathology, Inc.	750
4. Research in rickets, Johns Hopkins University and Harriet Lane Home	700
5. Executive Board	250
6. Secretary's office	250
Total	$13,000

The Executive Board of the Research Commission held one meeting during the fiscal year, in Washington, D. C., April 15-16, 1935, for the purpose of drawing up tentative rules and regulations to be followed by the Research Associates at the National Bureau of Standards, as well as to review applications for grants and other business coming before the Commission during the fiscal year.

GRANT NO. 1—AMERICAN DENTAL ASSOCIATION RESEARCH FELLOWSHIP, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

The cooperative research on the physical properties of dental materials by the Research Commission of the American Dental Association and the National Bureau of Standards has now continued for seven years. This work, which is constantly increasing its scope and influence, has the active support of the dental profession and the active cooperation of the large majority of the manufacturers of dental materials.

This fiscal year, the federal appropriation for this work was about $4,500. The Government personnel giving part or all of their time to this work are Wilmer Souder, Ph.D. (physicist) and I. C. Schoonover, Ph.D. (chemist). In addition to these two men, many other scientists of the Bureau staff give their services and advice when needed. One of the great advantages of having this work carried on at the National Bureau of Standards is the fact that its personnel and equipment in the fields of applied physics and chemistry are unexcelled.

The Research Commission allocated $8,800 for carrying on the work at the Bureau. Further appropriations of $1,200 and $300 were later secured by

*Fiscal year July 1, 1934-June 30, 1935.

special action of the Board of Trustees, making a total sum of $10,300 for this fiscal year. The additional $1,500 was used to pay the salary of Mr. John R. Beall, who was employed to test the certified materials, and for purchases of materials. There are now three full-time American Dental Association Research Associates stationed at the National Bureau of Standards; namely, George C. Paffenbarger, D.D.S., W. T. Sweeney, A.B. (physicist) and John R. Beall, B.S. (mechanical engineer).

OUTLINE OF WORK

The main objects of this investigation are to study technics and materials used in the practice of dentistry and to develop satisfactory standards for these materials. This is accomplished by (1) buying in the open market standard trade brands of materials; (2) determining those physical-chemical properties that are of importance in relation to their dental uses, and (3) formulating tentative specifications, using these surveys as a basis. The tentative specifications are submitted to dental schools and manufacturers for their suggestions. They are then presented to the Research Commission and the House of Delegates of the American Dental Association for consideration and approval, after which they become the official specifications of the Association. Up to the present time, eight such standards have been adopted, for: (1) amalgam, (2) inlay casting investment, (3) impression compound, (4) inlay casting wax, (5) inlay casting gold, (6) dental mercury, (7) wrought gold wire and (8) dental cementing medium.

Since it is the desire of the Commission that these specifications be kept at the highest possible level, they are now being revised.

After the adoption of the specifications by the American Dental Association, the Research Commission invites manufacturers of the materials concerned to certify formally that their products conform to the specified requirements. Lists of these certified products have been published from time to time in THE JOURNAL, the most recent lists appearing in the November, 1934, and June, 1935, issues. There are now 147 certified products on this list.

In order to test those products and, at the same time, continue the investigation on other materials, it was necessary to secure an additional employe. John R. Beall, B.S., a graduate of the University of Maryland, was selected by the Commission to do this work. The certified materials are procured on the open market and tested to ascertain whether they conform to the requirements of the specification. This program should in a large measure protect the dentist in his purchases of such materials.

A special meeting of the executive board was held at the Bureau of Standards in April for the purpose of adopting formal rules and regulations regarding the work at the Bureau of Standards. The board believes that the present policy, as relating to the publication of reports, is satisfactory. In the preliminary reports, the products are designated by symbols or letters, but, in subsequent testing, the brand name of the product is to be used. Those materials that comply with the specification (as certified to the Research Commission by the manufacturer and found to comply by the Research Associates at the National Bureau of Standards) are placed on the list. The materials that do not comply are omitted from the list. If the material is not certified to the Research Commission, but has a guarantee statement on the package claiming compliance with the A.D.A. specification, it will also be tested by the Research Associates if called to their at-

tention. If any material fails to comply with the specification as certified or guaranteed, the manufacturer is notified by the secretary of the Commission and is requested to correct the situation by withdrawing the product from the market, deleting the guarantee from the package or changing the product so that it conforms to the specification. If the manufacturer refuses to cooperate, the matter is placed before the Federal Trade Commission. After the first survey, no materials are accepted for certification until retail samples procured on the open market are first tested by the Research Associates at the National Bureau of Standards to determine whether they comply with the specification. Only one sample will be tested. If a material fails to comply, it may be recertified to the Commission, but it will be deleted from at least one publication of the list of certified products.

Since if the Commission purchased on the open market all of the certified materials in sufficient quantity for testing purposes, the cost would be about $5,600 annually, a system of procuring retail packages on the open market without outright purchase was adopted. The manufacturer, on certifying his material to the Commission, will sign a blank form authorizing an agent of the Research Commission to procure sufficient material for test purposes from any reputable retail dental dealer. The manufacturer will reimburse the dealer for the material thus used. Any expenses incurred by the dealer, together with a profit agreed on, will be paid by the Research Commission to the dealer. In case the material contains noble metals, the scrap metal will be returned to the manufacturer. Any loss in testing will be paid by the Commission at the current market intrinsic value of the noble metals.

The executive board of the Commission instructed the secretary to communicate with Lyman J. Briggs, director of the National Bureau of Standards, and request that all information regarding research on dental materials, as well as bulletins resulting therefrom, be abstracted and brought together in a special publication, in cooperation with the Research Commission.

The Commission is concerned with the falsity of any advertisements involving the A.D.A. specifications, because it desires to protect the dentist in purchasing materials. The secretary has corresponded with several firms about certain advertising of this nature which appeared to be misleading. In every instance, the situation was corrected by the manufacturer. The Commission believes that this method of correcting such conditions is a very satisfactory one. At the present time, its limited resources and personnel do not permit a systematic investigation of the advertising of dental materials. The Commission is able to investigate seemingly fraudulent claims only when the complaint is accompanied by supporting test data or other strong evidence that the claim is actually fraudulent.

The Commission desires that materials primarily used in prosthesis be investigated as carefully as many of the operative materials have been. Attempts to improve and develop new silicate cements also should be made. The educational phases of the work should be enlarged and emphasized. If this additional program is developed soon, the services of another man will be required.

An exhibit showing some phases of the work being carried on under this project may be found in the Exhibit of the Research Commission now on display in the Scientific Exhibit Section.

The following reports are being presented at this meeting:

1. "Chemical and Physical Properties

of the Silicate Cements," by George C. Paffenbarger, D.D.S., and I. C. Schoonover, Ph.D., presented before the Section on Operative Dentistry, Material Medica and Therapeutics.

2. "Progress Report on the Testing of Denture Materials," by W. T. Sweeney, A.B., presented before the Section on Full Denture Prosthesis.

3. "Standards for Dental Materials," by Wilmer Souder, Ph.D., and John R. Beall, B.S., presented before the Section on Partial Denture Prosthesis.

All of the above-mentioned Associates will give clinics at this meeting. A personal report by the Research Associates follows:

OUTLINE OF THE COOPERATIVE DENTAL RESEARCH
BETWEEN
THE NATIONAL BUREAU OF STANDARDS
AND
THE AMERICAN DENTAL ASSOCIATION
(1934-1935)

The cooperative research work on dental materials for the fiscal year 1934-1935 has dealt with (1) zinc phosphate cement, (2) cooperative cement work, (3) silicate cements, (4) denture materials (vulcanite and its substitutes), (5) testing of certified materials, (6) revision of specifications and (7) miscellaneous activities.

1. *Zinc Phosphate Cements.*—The tentative specification for zinc phosphate cements was submitted to manufacturers, dental schools and interested members of the profession, who suggested several minor changes, which were later incorporated in the specification. The Research Commission and the House of Delegates of the American Dental Association approved the specification and it is now the official A.D.A. Specification No. 8 for dental cementing medium (effective July 1, 1935). To date (June 30), five manufacturers have certified that their products comply with the specification and four other manufacturers have signified their intention of doing so.

The final zinc phosphate cement report: "Zinc Phosphate Cements: Physical Properties and a Specification," was published in the November, 1934, issue of THE JOURNAL.

2. *Cooperative Cement Work.*—A report was prepared on the findings of the committee of cooperating dentists who conducted a series of fifteen practical experiments on the zinc phosphate cements. The determination of compressive strengths and of dimensions of powder particles were made by the A.D.A. Research Associates at the National Bureau of Standards on samples submitted from the dentists. The report was published in the August issue of THE JOURNAL.

3. *Silicate Cements.*—The consistency test method used in the zinc phosphate cement study was modified so that it could be used for the same purpose in the silicate cement investigation. Several members of the cooperating committee of dentists were requested to conduct experiments to determine how much powder they were using in 0.4 c.c. of liquid. Their reports indicated that a consistency of mix which produced a disk having a diameter of 26 to 27 mm. was a suitable one for practical use. Accordingly, this consistency was used as a tentative standard. The amount of powder that could be incorporated in 0.4 c.c. of liquid to produce a mix of standard consistency varied from 0.65 to 1.50 gm., it depending on the brand of cement. The consistency test method together with the data for his own brand were sent by the director of the National Bureau of Standards to each manufacturer for suggestion and criticism.

The effect of the age of the specimens, of the powder-liquid ratio and of the immersion mediums on ultimate compressive strength of the cement was determined.

The Gillmore needle was used to determine the time of setting at room and at body temperature.

Qualitative shrinkage tests indicated that all of the cements shrank. Some cements

appeared to shrink less than others. Simple dye penetration tests using both acid and basic dyes showed that the basic dyes stained the cement much more readily. None of the cements were immune to staining although some appeared to stain less readily than others.

A chamber in which the temperature and humidity could be controlled was constructed.

4. *Denture Materials—Vulcanite and Its Substitutes.*—Last year, in the dental materials research laboratory at the National Bureau of Standards, Ronald Barber, of the Navy Dental Corps, commenced a study of denture materials. His report, "Preliminary Tests of Some of the Newer Denture Materials," was published in the November, 1934, issue of THE JOURNAL. The present investigation is a continuation of this type of work.

The following types of material are being investigated: vulcanite, types: veneer pink, denture pink, olive base, maroon, gold base and white; resins, types: phenol-formaldehyde, vinyl and cellulose compounds.

These materials are being subjected to the following tests: flexural fatigue, tensile (for determination of ultimate tensile strength, elastic limit and percentage of elongation), flow under stress (McBurney type of indentation test), tests to determine dimensional change on curing or pressing, heat transfer, water absorption and color life.

5. *Testing of Certified Materials.*—Continuous routine checking of materials that have been certified to the Research Commission by the manufacturers as complying with the A.D.A. specifications is in progress. The results of the fourth survey of amalgam alloys was published on page 1028 of the June, 1935, issue of THE JOURNAL. Approximately seventy-five samples of alloy that have been offered for certification by the manufacturer subsequently to this survey have been tested for compliance with the specification before the certificate of the manufacturer was accepted by the Research Commission. Ten additional samples have been tested since the publication of the survey. The ones that complied have been added to the list of certified products.

The second survey of certified inlay casting investments has been completed. The results of this survey will soon be published in THE JOURNAL.

The third survey of certified inlay casting waxes and impression compounds is in progress.

This testing of materials has been conducted largely by John R. Beall.

6. *Revision of A.D.A. Specifications.*—Pursuant to the policy of the Research Commission, the current A.D.A. specifications were submitted to manufacturers and dental schools for suggestions and criticisms. A résumé of the suggestions is being prepared for distribution to all interested parties. Possibly it may be necessary to hold a conference of all interested parties at the National Bureau of Standards, as the discussion is becoming too voluminous to be conducted by correspondence.

A standard test sample of amalgam alloy was prepared. A comparison of test data on this sample among the different laboratories equipped for this type of testing is now in active progress. About fifty tests were made on the standard sample in this laboratory. The specimens were prepared under a variety of mixing and packing procedures. The data obtained in this interchange of test results will be useful in the amalgam specification revision and will be a distinct aid in the standardization of amalgam testing.

7. *Miscellaneous.*—Approximately 160 persons visited the laboratory during the past year. Included among these were visitors from England and Belgium.

Reports of the work were presented at the Annual Session of the American Dental Association, St. Paul, Minn.; a meeting of the Ohio State Dental Society, Columbus, Ohio; the New York Centennial Meeting, New York City: Midwinter Clinic of the Chicago Dental Society, Chicago, Ill.; Five States Post-Graduate Clinic and District of Columbia Dental

Society, Washington, D. C.; a meeting of the Tennessee State Dental Association, Nashville, Tenn., and a meeting of the American Society of Orthodontists, New York City. It is estimated that 1,200 dentists were present when the reports were given.

An investigation was made on "Chief Castloy," which was advertised and represented as a white gold alloy, analysis revealing that the gold content of this alloy was very small, being only one part of gold in 2,500 parts of alloy. A report of this investigation was printed in the February, 1935, issue of THE JOURNAL.

An exhibit showing the work of the laboratory was made and presented at several state meetings.

Respectfully submitted,
GEORGE C. PAFFENBARGER,
W. T. SWEENEY,
Research Associates.

GRANT NO. 2—UNIVERSITY OF LOUISVILLE

This project has been financially assisted by the Research Commission for the past several years. A grant of $750 was allocated, which was used entirely for the purpose of assisting Theodore B. Beust in his research laboratory. An exhibit of the important and practical work being carried on under this project may be found in the Exhibit of the Research Commission now on display in the Scientific Exhibit Section.

The following is a personal report of the studies carried on under this grant, submitted by John T. O'Rourke, adviser:

SYNOPSIS OF STUDIES AND PUBLICATIONS BY THEODORE B. BEUST AT THE UNIVERSITY OF LOUISVILLE SCHOOL OF DENTISTRY JULY 1, 1934 TO JUNE 30, 1935

The activities were limited to studies of the fundamentals involved in the question of dental caries and mouth bacteriology.

The following papers were published:

1. "Development of Dentin Sclerosis," in the July, 1935, JOURNAL.

2. "Discussion of Dental Caries," *Journal of Pediatrics,* Vol. 5, No. 6, December, 1934, p. 841.

3. "Microorganisms of Gingival Inflammations," read before the Ohio State Dental Society, Columbus, November, 1934.

4. "The Fusiform Bacillus," read before the International Association for Dental Research, Chicago, March, 1935.

5. "Dens in Dente" (Beust and Freerichs), read before the International Association for Dental Research, Chicago, March, 1935.

The following exhibits were shown:

Booth, in the Scientific Exhibit of the American Dental Association, 1934; booth at the Southern Dental Clinic, Memphis, Tenn., October, 1934.

Respectfully submitted,
JOHN T. O'ROURKE,
Adviser.

GRANT NO. 3—THE NEW YORK INSTITUTE OF CLINICAL ORAL PATHOLOGY, INC.

Grant No. 3 has been in operation for the past two years. A grant of $750 was allocated by the Research Commission for the last fiscal year. An exhibit of the important and practical work being carried on under this project may be found in the exhibit of the Research Commission now on display in the Scientific Exhibit Section.

A paper entitled "Clinical Oral Pathology," with a lantern slide demonstration, is being presented by Theodor Blum before the Section on Oral Surgery, Exodontia and Anesthesia.

The following is a personal report of Theodor Blum, adviser to the Commission for this project:

SYNOPSIS OF RESEARCH BEING CARRIED ON AT THE NEW YORK INSTITUTE OF CLINICAL ORAL PATHOLOGY, INC.

1. A continued study of the comparative

reliability of the various types of electric pulp testers and the reliability of the various mechanical and electrical principles involved has been conducted in the same manner as that of the previous year. The following investigations have been completed in connection with the foregoing:

A. Studies with the Type I instrument, with the introduction of an ammeter in the circuit in an attempt to associate the various fluctuations in amperage with changes of the dental pulp as shown histologically.

B. A comparative study of a new instrument, Type III, involving a different mechanical and electrical principle.

C. A study of the Type I instrument using the two pole and one pole electrodes which are interchangeable on the same instrument. In this study, it is hoped to demonstrate the value of the two pole electrode with low voltage.

D. A study of a new instrument, Type IV, fundamentally similar to Type I.

2. Histologic studies of the dental pulps in various stages of peridental diseases, including the pulp test report on these teeth.

3. Bacteriologic studies of dental pulps, both normal and pathologic, for the determination of their importance as possible foci of infection. All teeth studied were pulp tested in a further attempt to predetermine possible foci by means of the pulp tester.

4. Comparative roentgenologic and histologic studies of unclassified bony growths of the maxilla. A report on these studies was read by Anna Furedi, M.D., pathologist of the Institute, before the New York Dental Centennial, Dec. 5, 1934, entitled: "A Study of the So-Called Osteofibromas of the Maxilla."

5. An Institute report was made by Theodor Blum, D.D.S., M.D., at the New York State Dental Society meeting at Saranac, N. Y., June, 1935, entitled "Clinical Oral Pathology." The purpose of the report was to further demonstrate the importance of clinical pathologic studies for establishing a diagnosis. This was demonstrated with many lantern slides.

6. Four new sciéntific exhibits have been completed, there now being a total of six, and have been on display and demonstrated at many medical and dental society meetings:

1. History of pulp testing. 2. Demonstration of the application of the pulp tester in practice. 3. Benign tumors and cysts of the jaws. 4. Topographic roentgen-ray studies of gross anatomic sections of the head, prepared for study of conduction anesthesia.

Respectfully submitted,
THEODOR BLUM, *Adviser.*

GRANT NO. 4—RESEARCH IN RICKETS, JOHNS HOPKINS UNIVERSITY AND HARRIET LANE HOME

Grant No. 4 has been in operation for the past two years and the first phase of this investigation has been finished. The Research Commission allocated $700 for this project during the last fiscal year, but no additional funds will be requested for this year.

This study has been made possible by the enthusiastic cooperation of Edwards A. Park, chief of the pediatric service, and other officials at the Harriet Lane Home of the Johns Hopkins University, aided by the Johns Hopkins dental staff, and a contribution made for dental research by Miss Etta Cone. This contribution was given through H. H. Streett of Baltimore, Md.

A report of this valuable study is being presented before the Section on Research at this meeting by George M. Anderson, D.D.S. and D. H. Shelling, M.D., entitled: "The Relation of Rickets and Vitamin D to the Incidence of Dental Caries, Hypoplasia and Malocclusion in Children." An exhibit of approximately 300 models will be found in the exhibit of the Research Commission now on display in the Scientific Exhibit Section.

The following personal report is submitted from H. E. Kelsey, member of the

executive board of the Research Commission, and adviser for this project:

SYNOPSIS OF RESEARCH IN RICKETS
JOHNS HOPKINS UNIVERSITY
AND
HARRIET LANE HOME

The research this year was concerned with children who have, from infancy, been brought to the Harriet Lane Home for supervision regarding their diet. These children also were all given viosterol, and none of them developed rickets. Last year's work, under the same grant from the American Dental Association, was with children all of whom were known to have had rickets. The hospital roentgen-ray facilities and space in the dental clinic were freely given to carry on the work.

The dental phases were under the supervision of George M. Anderson, assisted by Kyrle W. Preis and Edith Bill. Mrs. P. M. Siewierski, of the Social Service Department of the Johns Hopkins Hospital, was in charge of the work of getting the children to the hospital and returning them to their homes. She was aided by Mrs. J. L. Woods and Mrs. Katherine Heisler, who donated their services, including the use of their cars to the work.

The general physical examinations were made by D. H. Shelling, as was also the case last year.

The funds that were allocated by the American Dental Association for this research work were all used, in addition to some of the funds contributed by Miss Etta Cone to dental research as a memorial to her sister, Claribel Cone.

We do not ask for a continuance of this grant at this time, because it is thought that, after two or three years, it can be taken up more profitably, with a recheck of many of the cases that are included in the present report.

Table 1 shows the number of cases, number of completed cases and number of

TABLE 2.—EXPENDITURES FROM RESEARCH FUND

	Grant for 1934-1935	Disbursed June 30, 1935	Unexpended Balance
1. American Dental Association Research Fellowship at the National Bureau of Standards	$10,360.00	$10,360.00	
2. University of Louisville	750.00	750.00	
3. New York Institute of Clinical Oral Pathology, Inc.	750.00	750.00	
4. Research in Rickets, Johns Hopkins University	700.00	700.00	
5. Executive Board	224.70	224.70	
6. Secretary's Office	215.30	215.26	00.04
	$13,000.00	$12,999.96	$00.04
Allocated by Research Commission		$ 8,800.00	
Appropriated by Board of Trustees, Nov. 1, 1934		1,200.00	
Appropriated by Board of Trustees, June 2, 1935		300.00	
Allocated by Executive Board from Executive Board and Secretary's Office allotments		60.00	
		$10,360.00	

TABLE 1.—RICKETS RESEARCH CLINIC DATA

	February	March	April	May	Total
Clinics held	9	8	9	7	33
Cases contacted	97	116	80	54	347
Cases completed	42	45	35	28	150
Visits paid	187	188	179	135	679

visits paid to the Rickets Research Clinic.

Respectfully submitted,

H. E. KELSEY, *Adviser.*

COMPARATIVE FINANCIAL STATEMENT

Table 2 shows the expenditures during the fiscal year from the $13,000 appropriated to the Research Commission. Only 3⅓ per cent of this amount has been expended for administration. For the present fiscal year, the Research Commission is requesting an increase of $3,250 in order that the various projects may be more ably assisted.

Respectfully submitted,

P. C. LOWERY, *Chairman,*

C. T. MESSNER, *Secretary.*

BROKEN NEEDLES IN MANDIBULAR BLOCKING

By H. J. SCHWARZ, D.D.S., St. Louis, Mo.

ALL cases of broken needles in mandibular anesthesia may be differentiated into cases in which the blocking is anatomically correct and cases in which it is incorrect.

Should the procedure of mandibular blocking be performed in accordance with anatomic indications, the removing of broken needles would present no difficulties. In correct blocking, when the needle is inserted about an inch of its length, the point is retained on the bottom of the mandibular foramen, while the inserted part lies horizontally on the internal surface of the ramus.

At whichever point the needle breaks, its fragment must lodge in front of the mandibular foramen and, without changing its horizontal position, remain so until it is removed.

Considering the position and function of the neighboring structures—internal pterygoid and temporal muscles and the internal lateral ligament—we should have no fear that the needle will migrate backward toward the throat or upward, or, in fact, anywhere.

We may be certain that, in all such cases, we shall find the broken needle where we anticipate it to be, and there is no need of having a roentgenogram made before proceeding to remove it.

The simplest and easiest way of removing a broken needle in correct blocking is as follows:

1. Anesthetize the necessary part. 2. Make an incision from the back of the third molar over the internal margin of the ramus or over the retromolar fossa and carry the incision up for about one inch. 3. Dissect the flap off the bone, watching for the appearance of the needle, and, as soon as you see its anterior end, pick it up with cotton pliers. 4. Make one suture.

It is quite different in cases in which the mandibular blocking is anatomically wrong. The fractured needle then may be situated in various regions—behind, above or below the mandibular foramen. This complicates the locating of the needle and the method of removing it. Left alone beyond the posterior margin of the ramus, the needle may migrate backward and downward by the action of the muscles of the pharynx and neck and the case may become quite serious. The immediate removal of the needle in such cases is urgent, while the method of removing may be various.

Serious attention should be paid by the general practitioner to data on broken needles, and he must restrain himself from blocking the mandible in a haphazard manner. He must learn the anatomy of the mandible thoroughly and adopt a correct procedure for mandibular blocking, and only thus can he be free from anxiety.

5579 Delmar Boulevard.

The Journal of the American Dental Association

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor

Published by the American Dental Association

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Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $5.00 a year in advance, this rate applying to both domestic and foreign subscribers. All foreign subscriptions are to be paid in United States money.

Editorials

THE AFTERMATH

Following the receipt of the responses from the Christmas seals each year, there is a real thrill in contemplation of the genuine outburst of enthusiasm and good will that comes pouring in to the Central Office. This year has been no exception. In fact, at the present writing, it looks as if the response would exceed that of previous years.

Even when members have felt it impossible to contribute a dollar, many of them have written letters telling of their regret, and in no uncertain terms expressing their wholehearted commendation of the movement and their entire sympathy with it. To go over these letters is equal to a benediction. There is sufficient heart-warming in them to encompass a multitude of readers, and if they could all be published, which of course they cannot, it would furnish a very powerful propaganda for the movement.

It is doubtful that any one of the many laudable enterprises which have been inaugurated by the American Dental Association has ever called forth a more spontaneous and universal response

from the entire membership than has this activity of dental relief.

And speaking of the dollar, it should be remembered that certain of our members are in the habit of sending more than that amount, some of them sending in as much as twenty-five dollars. All of this is most gratifying, and it is an indication of the great good-heartedness of members that they respond so generously. But let it not be inferred that we in any way belittle or despise the dollar subscription. It is on the basis of the dollar that most of the fund has been built, and we all know only too well that the goodness of heart and the sacrifice represented by the payment of a single dollar on the part of some of our members may be just as great as that of others who are fortunately so situated that they can conveniently pay more. There is an eclecticism in this whole movement that has constituted one of its greatest appeals and which has probably contributed more to its success than any other thing connected with it.

It would seem appropriate at this time to give a few facts for the benefit of our entire membership. The average annual contributions to the fund for the past ten years amount to $15,717.49. The total Relief Fund Nov. 30, 1935, was $370,394.58. The total sum disbursed for relief by the A.D.A., the state and the component societies since the first payment was made April 25, 1925, to Nov. 30, 1935, amounts to $106,547.26; half of which has come from the parent body, and half from the state and components. This is a showing of which every member of the Association may well be proud. It must never be lost sight of that, in dispensing relief, only the interest on the fund can be utilized; therefore, the larger the fund, the greater the amount of relief that is made available. If the Association should ever make the mistake of dipping into the principle, the money would soon be scattered.

There has been a constant effort on the part of the Relief Commission and Relief Committee to cooperate in every way with the state authorities. It is true that, in certain instances, more money has been contributed from a state through the medium of the Christmas seals than has been paid to the members of that state for relief, but, on the other hand, there are certain states where beneficiaries have received much more in relief than their mem-

bers have contributed in seals. This disparity in circumstance seems to be inevitable.

At the 1935 meeting in New Orleans, some revision of the plan was made to the end that the greatest equity is established for all concerned, and the burden is made easier for the individual states. Provision was made for the return to the state of 50 per cent of the amount received from the sale of the seals in any given state, provided certain reasonable conditions were agreed to by the state, the details of which may be learned from the Relief Commission. This will at once tend to lighten the burden on the state.

Occasionally, some objection has been raised to the time and financial limitation in the awarding of grants. The following provisions have been made after the most careful and conscientious deliberation: The number of grants to any one recipient shall be limited as follows:

A membership of from three to five years, inclusive, is limited to one grant and a maximum amount not to exceed $300.

A membership of from six to twenty years, inclusive, is limited to two grants not to exceed $600 total.

A membership of from twenty-one to thirty-five years, inclusive, is limited to three grants not to exceed $900 total.

In a membership of thirty-six years or over, provision is left to the discretion of the members of the Relief Commission and the Trustees of the A.D.A.

The thing that needs emphasizing most pointedly is that this is not a *pension* fund, but a *relief* fund, as its name implies, and if this policy were not adhered to rigidly, the fund that has been built up only after the most strenuous efforts would very rapidly be dissipated. It seems to be one of the prevalent tendencies of the times, a tendency fostered largely by the legislative bodies of the state and nation, to dispense funds lavishly and without judgment, the moment any funds are sighted, and it would be asking almost too much of human nature to suppose that the members of the dental profession were any exception.

It is the most natural thing in the world and in strict accord with the generous impulses of our common humanity to want to continue benefactions of this kind indefinitely. The goodness of

heart of many of our members, particularly those connected with the personnel of the state relief bodies, who usually know the applicants personally and whose sympathy is thus naturally aroused, may always be counted on to argue for a more liberal policy in dispensing funds; but, in the conservative and successful administration of this enterprise, something more is needed than mere goodness of heart. Had it not been for the fact that our Association was blessed with certain men of discriminating judgment and broadminded vision who were willing to sacrifice their time and energy for the good of the cause, we would today not have any relief fund to safeguard the welfare of unfortunate members. To these fine men of the relief administration, we are indebted more than can ever be known for their wise counsel and devotion to duty, and it should also be said that our officials have uniformly supported them to the utmost of their ability. This one enterprise in itself, with all of the good that has been done, goes a long way toward justifying the existence of the American Dental Association, and our thanks and congratulations go to every one who has had anything to do with it.

ADVERTISING AND ADVERTISING

Advertising is a very worthy and even an honorable pursuit. That is, advertising of a legitimate character. Advertising, on the other hand, may become the medium of a vicious and wholly unworthy propaganda against the public welfare. This is being recognized to the extent that certain of the great advertising agencies themselves are frowning on some of the prevalent methods of the day, and demanding that reform be instituted, to the end that misrepresentation in public advertising be eliminated.

One of the forms in which misrepresentation may occur is found in the manner in which certain tooth pastes and powders are sometimes advertised in the public press. Some of this advertising is directly misleading and therefore pernicious, and one of its worst features is the attempt to use dentists as propagandists for the purpose of leaving the inference that members of the profession are sponsoring some particular product.

The use of the profession in this way is always cloaked in anonymity. "So he went to his dentist," "and when he saw his dentist," "and then he went to his dentist," and "followed his advice." Phrases like these mislead the public: "Do as your dentist does," "Your dentist will tell you," "Your dentist uses," "Dentists advise," etc. No dentist of any repute would ever think of having his name used in connection with such propaganda as this, and the inference that dentists generally, or that any individual dentist, could ever be found subscribing to such advertising is beyond belief.

It is high time that this objectionable form of advertising be winnowed out of the public press. It practically constitutes itself an insult to the intelligence of the better element of the profession and even of the public, and must inevitably do incalculable harm. If the propagandists only knew it, they are prejudicing their interests whenever they resort to such ill advised and transparent nonsense as this. The public are not all fools nor are they wholly lacking in discrimination; and the sooner the advertisers recognize this fact and abstain from attempted exploitation of this sort, the better it will be for them.

But in all fairness it should be said that there is another side to this question. Let us not forget the fact that the extensive advertising of tooth pastes in the public press has probably directed attention to the desirability of giving greater care to the teeth on the part of the reading public, and to that extent it has undoubtedly served a useful purpose. To put it concretely, there is no question that the teeth of the American people are in better condition today than they would have been without the use of tooth pastes or powders and the advertising that has gone with them. We must aim to be fair in all ways, and not withhold acknowledgment where acknowledgment is indicated.

But speaking of advertising, here is something that is even more deplorable than some of the ordinary forms of advertising that we have felt like condemning. In the public press a short time ago, an article was released to the effect that a new substance had been discovered to make "the dentist's drill a painless instrument." It was announced as emanating from a great university. The dis-

covery was made "after twenty years of research" and the substance was described as a "desensitizer." It is "a solution applied to the surface of the tooth. . . . It not only prevents pain," it was stated "but offers the possibility of saving teeth now lost through extraction."

It is inconceivable how such an article should ever have been released as coming from a responsible source. Great inventions or discoveries in medicine or dentistry are never launched through agencies of this character. It might be considered significant that the name of the discoverer is given, but there is not the slightest hint of what the product is.

The whole circumstance is so out of keeping with the well established order of procedure in the introduction of any new remedy that we can only wonder whether there is anything new in it or indeed it is a remedy at all. The situation smacks too much of the patent medicine man's ordinary stock in trade to entitle the product to any consideration, and the pity is that it should have emanated from a source so prominent. If it is true that a great discovery has been made, there were available for its introduction the proper professional channels, and those channels were not represented by new agencies catering to more than a thousand press subscribers.

This profession of ours must keep its own skirts clean if it expects to command the respect of the intelligent public.

Yes, there is advertising and advertising.

Obituary

EMORY ADDISON BRYANT, D.D.S.

(1863-1935)

Commander Emory Addison Bryant (Dental Corps), U. S. Navy (Retired), died at 7:20 p. m., Monday, Nov. 25, 1935, at the Naval Hospital, after a brief illness.

Dr. Bryant was born at Kalamazoo, Mich., Aug. 10, 1863. He was graduated from the Baltimore College of Dental Surgery, Baltimore, Md., in 1886, and for many years practiced dentistry in Washington. In 1912, he and Lieutenant Commander William N. Cogan (DC), retired, now dean of Georgetown University School of

Dentistry, commenced the organization of the Dental Corps of the U. S. Navy. Dr. Bryant was graduated in law from George Washington University and National University of Washington, and was admitted to practice law before the courts of the District of Columbia and the U. S. Supreme Court. He was a specialist in patent law.

Dr. Bryant was considered an authority on the history of ether anesthesia. He was retired from the Navy Jan. 28, 1929, having reached the statutory retirement age, and was relieved from active duty March 15, 1929.

The widow, residing in Washington, D. C., a son, George E. Bryant, and two daughters, Mrs. Florence Bryant MacKenzie and Mrs. Pierre A. Chamberlin, survive.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Casting—Cristobalite takes the guesswork out of casting.—*C. C. Norris, Oshkosh, Wis.*

Wax Eliminator—Place a piece of sheet iron on a bunsen burner; place on it your largest casting ring, and use a sprue former inverted for a lid.—*C. C. Norris, Oshkosh, Wis.*

Matrix—A matrix for large inlays or three-quarter crowns can be made by using a piece of matrix material cut in the shape of a capital letter T. The base of letter is the width of the occlusal surface of the tooth. Bend it over, forming a lid, and hold the ends between the fingers.—*C. C. Norris, Oshkosh, Wis.*

Canker Sores—For canker sores, dry the surface and touch the spot with saturate solution of trichloracetic acid on the flat sharpened end of a wooden applicator, protecting the cheek, and wash immediately with water from syringe. Also use under the free margin of the gum for an inflamed partially erupted third molar.—*C. C. Norris, Oshkosh, Wis.*

Treatment of Retention Cysts—Of the retention cysts, the mucoid cyst may be observed on the mucous membrane of the lips and cheeks in the vestibule of the mouth. If these are merely incised, they invariably recur. To prevent recurrence, the entire cyst should be dissected out and the mucous membrane sutured.—*James L. Zemsky, 147 Fourth Ave., New York City.*

I Advise—Many dentists assume a negative attitude in their contacts with advice seeking patients. Such expressions as "I recommend," "I suggest," "I believe," "I think," "it might be best," "you should have," "probably," "perhaps," "maybe," "why don't you?" "you should," carry little weight of a positive nature. After a careful examination and a thorough study of the case, nothing inspires such confidence in the patient as the words "I advise."—*Herbert Ely Williams, Red Bank, N. J.*

Jour. A.D.A. Vol. 23, January, 1936

Advantages of Local Anesthesia—In many cases, local anesthesia will ease the burden of the patient by abolishing the surgical shock that may follow operation and by doing away with the disagreeable and at times dangerous after-effects of a general anesthetic. Also, it enables the surgeon to work with perfect safety and ease because of the complete relaxation of the patient's muscles, as well as his assistance and co-operation, as, for instance, his ability to open the mouth and turn the head.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Care in Removal of Impacted Lower Third Molar—In the removal of impacted lower third molars, avoid unnecessary or undue force. If the tooth is offering resistance, the cause must be ascertained. Either it is wedged against the second molar or the bone overlying the distal portion of the tooth is responsible. Determine the cause and remove it, then apply leverage. If there is mobility, continue the leverage until the tooth is delivered. In some instances, in order to remove the "lock," it is necessary to cut part of the crown portion of the impacted tooth.—*Julius Caplan, 4802 Broadway, Chicago, Ill.*

Exposure of Field in Removal of Molar—In exposure of the field in removal of the partially impacted lower third molar, after the usual incision is made, a periostome is used for peeling the mucoperiosteal flap from the bone. It will be found that it is difficult to begin this peeling. The tissue is quite firmly adherent around the third molar. With a very sharp knife in one hand and a tissue or tenaculum forceps in the other, this tissue is carefully dissected from the tooth and cut down through the periosteum, to the bone. The periosteum must be carried along with the flap. After the flap has been freed from this area, it will peel back freely.—*Julius Caplan, 4802 Broadway, Chicago, Ill.*

History and Clinical and Roentgenographic Examination—Of the surgical operations that the dentist is called on to perform frequently, the extraction of teeth occupies the most prominent place in his daily practice. Although extraction is routine work for a dental surgeon, every patient who comes to him to have teeth "pulled" should be considered carefully to determine the advisability of the procedure. In the course of such consideration, a thorough history should be taken and a clinical examination, together with most painstakingly roentgenographic survey of the mouth, made. There are various conditions in which extraction of teeth is not only unwarranted, but absolutely unjustifiable. Hastily performed operations may lead to law suits.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Those Two Hands and Ten Fingers—Dental practitioners valuing their hands and fingers show bad judgment in playing the rôle of expert machinist. The normal and uninjured hands of the dentist are not fully appreciated until something happens to them. The turning over of marine motors, cranking of automobiles or anything else of a hazardous nature should be refrained from as much as possible. Such work should be detailed to others whose hands and fingers are less valuable from the viewpoint of accomplishing the delicate, manipulative work of the dentist. Dentistry is the work of dental fingers, which must be closely safeguarded. A full complement of digital appendages is more imperative in gold foil technic than in any other phase of dental procedure.—*Herbert Ely Williams, Red Bank, N. J.*

COUNCIL ON DENTAL THERAPEUTICS

CALCIUM AND PHOSPHORUS COMPOUNDS IN DENTISTRY

The Council has authorized publication of the following report as representing its position on calcium and phosphorus medication for the prevention and control of dental caries.

SAMUEL M. GORDON, *Secretary.*

Efforts at promotion of calcium and phosphorus compounds in the minds of the dental and medical profession have been increasing in recent years. The high point of these efforts revolves around the assumed lack of calcium intake in the diet and the belief that the general ingestion of calcium and phosphorus compounds is beneficial in overcoming specific or nonspecific conditions presumably due to what is glibly termed "calcium imbalances." Hence, it is desirable to review in general the functions, actions and uses of calcium in human physiology and nutrition.

The functions of calcium compounds in pharmacology and nutrition are fairly well understood. Such diseases as rickets, osteomalacia, and osteoparathyrosis are accompanied by an inadequate deposition of calcium in the bones, but these conditions are not benefited by the administration of calcium salts except in rare experimental conditions wherein calcium has been almost totally lacking in the diet. Dental caries is also placed among those conditions that may be influenced by faulty calcium metabolism.

The pharmacodynamic responses to calcium salts are relatively slow, but more prompt than the nutritional effects of these salts. In other words, calcium metabolism in the body is generally associated with chronic rather than acute conditions. It is this latter fact which has given rise to investigation on the calcium (and phosphorus) (by phosphorus one refers to the element, but the requirement is in relation to phosphorus compounds, chiefly phosphate) requirements of the body for growth, maintenance and "good health."

The following tabulation, adapted from Bernheim[1] summarizes the essential points in calcium metabolism.

ESSENTIAL FACTORS IN CALCIUM METABOLISM

Intake:
- Food
- Water
- Calcium salts (as such)

Absorption: Through the intestines regulated by:

1. p_H within the intestine: salts are presumably absorbed in proportion to their relative solubilities
   - Acid p_H 3.0-6.9: calcium salts are soluble in acid solutions
   - Neutral p_H 7.0
   - Alkaline p_H 7.8-9.8: intestinal, pancreatic, biliary secretions are alkaline. Calcium salts are insoluble in alkaline solutions.
2. Other substances in the diet
   - (*a*) Excessive fats: calcium soaps of fatty acids are not absorbed.
   - (*b*) Excess of phosphates: tertiary calcium phosphate is insoluble.
   - (*c*) Oxalic acid (in leafy vegetables): calcium oxalate is insoluble.

1. Bernheim, Alice R.: J.A.M.A., 100:1002 (April 1) 1933.

(*d*) Lactose in fairly large amounts promotes absorption.

Blood:

$$\frac{\text{Total calcium content}}{\text{(average normal)}} = 10 \text{ mg. per } 100 \text{ c.c. (approximately)}$$

1. Nondiffusible = about 5 mg. (bound to protein)
2. Diffusible
   (*a*) Ionic = about 2 mg.
   (*b*) Complex Ionic = about 3 mg.

Relative concentration of these forms is determined by
1. Parathyroid glands
2. Vitamin D
3. Amount of blood protein
4. The acid base equilibrium
5. Amount of inorganic phosphate

Nondiffusible calcium varies directly with the blood protein.

Diffusible calcium increases with decrease in p_H. Concentration of calcium is inversely proportional to that of phosphorus.

Bone:

1. Shafts ⟷ blood
2. Trabeculae ⟷ blood

Excretion:

1. Feces (70 per cent or more)
2. Urine (30 per cent or less)

Most of the calcium in the body is combined as phosphate and carbonate to form the inorganic structure of the bones and teeth. The results of balance experiments indicate that the minimal requirements of calcium for a normal adult of 70 kg. (150 pounds) is about 0.45 gm. of calcium a day, and 50 per cent more, or 0.68 gm., represents a safe margin.[2]

The average American diet, if it includes milk or milk products, supplies just about enough calcium. When an unusual diet is taken or when the body undergoes conditions, such as pregnancy and lactation, that increase the requirements, there may be temporarily a calcium deficiency. In such cases, no one has yet demonstrated that calcium "excreted" into the fetus and into milk would not otherwise be excreted in feces and in the urine. Hanson has recently pointed out in a review of the physiology of the parathyroid the observation that the fetus is a calcium-phosphorus robber during gestation and lactation and nature may have provided these accessory parathyroids for the purpose of meeting this as well as accidental demands.[3]

The need of the body for calcium has given rise to much discussion about the quantitative requirements. The Council on Pharmacy and Chemistry of the American Medical Association holds that the average American diet supplies about enough calcium for normal requirements. This attitude is shared by the Council on Dental Therapeutics.[4] Both groups are agreed that a nutritional deficiency of calcium, if such exists, may best be remedied by the administration of natural foods having a high calcium content, such as milk and other dairy products, green vegetables and eggs, supplemented by vitamin D. Little or no emphasis is placed on supplementing the diet with any of the forms of "calcium phosphate" now being widely promoted, or on the glycerophosphates of earlier days. Sherman puts the case succinctly:

> If every child got a quart of milk, and every adult a pint daily, with a reasonably good selection of food for the rest of the diet, all the calcium and phosphorus requirements of normal nutrition would be met.

Manufacturers of pharmaceuticals suggest a different way of meeting the food requirements for calcium and phosphorus. A variety of brands of calcium and phosphorus combinations are actively promoted, to the public directly and through the dental and medical

2. Sherman, H. C.; Rose, A. R., and Rose, M. S.: J. Biol. Chem., 44:21 (Oct.) 1920.
3. Hanson, A. M.: Physiology of Parathyroid, J.A.M.A., 105:113 (July 13) 1935.
4. Accepted Dental Remedies, 1935, p. 69.

professions. Inquiries that come to the Council indicate that dentists are being called on to advise their patients concerning the usefulness of these products and the validity of the evidence used to promote them.

In addition to being marketed as sources of calcium to be taken in addition to or as part of the dietary, these preparations are offered for the following specific and nonspecific conditions: pregnancy, "child growth," convalescence, bone fractures, tetany, edeamatic conditions, tuberculosis and delayed clotting time, and for the prevention of dental caries. Frequent reference is made to scientific literature to support these claims directly or indirectly. In many cases, unwarranted liberty is taken with published findings. These will be discussed separately under the individual products. The following discussion is restricted as far as possible to phases of general dental interest.

ABSORBABILITY OF CALCIUM SALTS

Any discussion of calcium metabolism must be preceded by a discussion of the absorbability of various calcium compounds.

Calcium chloride because of its solubility is the most readily absorbed of all the calcium salts. It has other side reactions that may militate against its use. Where promptness of action and avoidance of irritation are desired, the less irritant calcium lactate and nonirritant calcium gluconate may be used. All calcium salts are administered in relatively large amounts because of their slow absorbability. There is some basis for urging that phosphates be supplied along with calcium because of the interrelationships of these two elements in metabolism. Hence, various compounds of calcium and phosphorus have been offered, with the claim that they supply both calcium and phosphorus in a form easily taken up by the system. The optimum ratio of calcium to phosphorus is difficult to define. It has been suggested that a ratio of the two elements similar to that found in bone might be used, but there is no adequate experimental evidence in support of this view.

All forms of calcium phosphate are, as a rule, insoluble in water and in alkaline mediums, while soluble in an acid medium. When taken orally, they must be converted into a soluble form before absorption. Hence, when calcium phosphate enters the stomach, it presumably reacts with the hydrochloric acid and is converted into the chloride, and is so made ready for absorption. It is absorbed from the small intestines, the contents of which are acid or relatively so. Further down the digestive tract, the calcium and phosphorus are in an alkaline medium and are precipitated in the feces largely as phosphates and calcium soaps. Calcium is also excreted largely by the large intestine, very little appearing in the urine.

The foregoing sequence of events represents a brief summary of current biochemical information regarding this problem. The point to be emphasized is that all calcium salts, according to this view, must be rendered soluble before they can be absorbed. The acidity of the gastric juice and of the intestinal contents; the amounts of phosphate and fat present, and the presence or absence of lactose are some of the conditions determining the absorbability of calcium. The action of the parathyroids and vitamin D are also important factors in absorption.

INORGANIC VS. ORGANIC CALCIUM-PHOSPHORUS COMBINATIONS

Claims are put forward that certain salts of calcium were more utilizable than others and also that calcium-phosphorus combinations derived from natural materials such as milk and vegetable matter possess special advantages. This, it will be noted, is a recent manifestation of the glycerophosphate fad of earlier days. How far does the evidence support these views?

It is well established that insoluble salts of calcium such as the carbonate and the phosphate are absorbed almost as well as any of the calcium salts because they are first converted into soluble forms in the digestive tract. There is much evidence to support this view. Only the comprehensive experiments of Steenbock and co-workers in 1923 need

be mentioned. They found no difference in the availability of calcium from the lactate, carbonate, phosphate, silicate or sulphate when these salts were fed in liberal amounts to rats on a calcium depleted dietary. Hence, they concluded that the solubility in hydrochloric acid is an essential factor in determining the availability of calcium salts. These experiments did not include dicalcium phosphate, which now occupies a prominent place, since it has become available on a commercial scale recently. C. J. Bloom[5] advocated the use of dicalcium phosphate in the treatment of rickets. This report is extensively quoted in support of the advertised claims for dicalcium phosphate. The referee shares the appraisal of the Council on Pharmacy and Chemistry that Bloom's paper does not bear critical analysis, and since it is the sole clinical evidence of the value of this therapy, not to mention the advantage of dicalcium over tricalcium phosphate, it cannot be considered as established. It should also be noted that Bloom's paper referred to rickets, although his data are advanced in support of its dental use.[6] The relation of rickets to caries is discussed farther on.

Recent evidence that there is no marked differences between dicalcium and tricalcium phosphate comes from the animal experiments of Rottenstein and Maynard.[7] They conclude:

> Throughout these experiments such differences as were shown between the supplements under comparison generally favored a secondary phosphate over a tertiary product, but we are unwilling to consider this combined evidence as certain of proof, because of the small differences involved and the variability of the individual data. It seems very unlikely that any differences which may actually exist are large enough to be of appreciable importance in the selection and use of mineral supplements in practice.

This disposes of any reputed differences between the two forms. There still remains the question: Should not dicalcium phosphate be made as readily available as tricalcium phosphate for cases of proven calcium deficiency? An answer to this depends on the usefulness of calcium supplements in prevention and treatment of caries and related conditions, and an answer is deferred until the evidence is further reviewed.

From the foregoing, it may be appreciated that the calcium from all common salts is available. The old idea that calcium and phosphorus in organic combination are preferable is being resurrected in support of several proprietary brands of calcium products (Phos-Cal, McKesson and Robbins, and Calciphos, Bilhuber-Knoll).

From 1895 to 1910, there was a widespread belief that the presence of organically bound phosphorus was of great importance. In 1907, McCollum[8] showed that when animals are placed on calcium depleted diets, the body can use inorganic phosphates to meet all its phosphorus demands. The statement of Mendel ". . . the once debated question of superiority of calcium and phosphorus and iron when furnished in some organic form or combination, no longer excites interest . . ." aptly summarizes the current accepted view.

This does not necessarily mean that sources of nutritional calcium from whole milk and other natural foods are not to be preferred to the inorganic form. Milk, for example, contains lactose, which aids in the absorption of calcium by creating a relative acidity in the small intestine, and the dispersion and dilution of the calcium and phosphorus in the milk may not be unimportant factors. It contains the three nutrients, protein, fat and carbohydrate, and vitamins A, B, C, D and G. Sherman and Campbell[9] have shown in rats that an increase of the proportion of milk in an already adequate diet improves the

5. Bloom, C. J.: Rickets, New Treatment, Preliminary Report, South. M. J., 25:1109 (Nov.) 1932; abstr. J.A.M.A., 100:532 (Feb. 18) 1933.
6. Bloom, C. J.: J.A.M.A., 100:1767 (June 3) 1933.
7. Rottenstein, K. V., and Maynard, L. A.: J. Nutrition, 8:715 (Dec.) 1934.
8. McCollum, E. V.: Am. J. Physiol., 25:120, 1909; Newer Knowledge of Nutrition, Ed. 2. New York City: Macmillan Co., 1929, p. 11.
9. Sherman, H. C., and Campbell, H. L.: J. Biol. Chem., 60:51 (May) 1924.

general nutrition. It is the best form of calcium and phosphorus for nutritional needs. Vitamins B_2 and D and iron, in which it is deficient, can be readily furnished by foods rich in these substances. Indeed, Sherman wisely stresses the value of "whole foods."[10]

Thus, it may be seen that more evidence than is available is necessary to support the claims that calcium (and phosphorus) in addition to that afforded by a well rounded dietary are needed by the body.

It is outside the scope of the report to consider in detail the calcium-phosphorus ratios needed for growth and maintenance. Suffice it to say that an excess of either necessarily upsets the metabolism of the other. As regards exchange between the skeletal substance and the blood, as excreted fluids and solids, one is dependent on the other. In considering the availability of calcium and phosphorus for the skeletal substance, the important rôle of vitamin D, the parathyroids and the thyroid must not be overlooked.

AVAILABILITY VS. PROMPTNESS

The availability of all forms of calcium compounds is not necessarily synonymous with rapidity of therapeutic effect. It is thus necessary to distinguish between the "nutritional" and "pharmacodynamic" actions of calcium compounds.

It is generally accepted that calcium metabolism is dependent on the parathyroids and on a proper level of vitamin D. The exact mechanism involved is yet a matter of experiment. When the parathyroids of experimental animals are extirpated or there is a parathyroid deficiency, the serum calcium is lowered below the normal range, convulsions resulting. Parathyroidectomized animals fed as much as 60 gm. (2 ounces) of bone ash (tricalcium phosphate) did not recover, but ingestion of 10-15 gm. of calcium lactate or gluconate had an immediate effect in overcoming the convulsions. This fact may be of some significance in interpreting the claims that the "calcium phosphates" are desirable because the calcium-phosphorus ratio approximates that of the skeletal substance.

Up to this point, the general actions and uses of calcium (and phosphorus) have been discussed without particular reference to the dental problem. Here, the evidence is even more contradictory, but it is reviewed in order that the profession may have before it a picture of the facts.

DENTAL INTEREST IN CALCIUM AND PHOSPHORUS

Generally speaking, the dentist is primarily interested in the following special aspects of calcium metabolism: 1. Are disorders of the teeth, notably dental caries, related to the dietary intake of calcium (and phosphorus)? 2. Is the development of sound teeth *in utero* dependent on a high intake of calcium during pregnancy? 3. Is there a calcium drain on the mother during pregnancy and lactation, and, if so, is this drain related to the carious process?

Direct answers to these questions are not readily available, for the evidence is replete with contradictions. Yet certain definite conclusions that seem to be generally acceptable will appear as the evidence quoted is unfolded. At the same time, it should be emphasized that the absence of definite evidence calls for caution regarding overenthusiastic promotion of diets supplemented by the addition of calcium and phosphorus powder or tablets. To do so would exaggerate certain unconfirmed factors at the expense of well-established procedures, coming under operative dentistry, which, though not preventive of caries, are at least arrestive of the process.

It may be conceded that dental caries, hypoplasia of the enamel and related conditions are associated with the proper utilization of calcium and phosphorus and vitamin D, to mention only the most prominent factors, although the evidence on this point is far from clear. It should not be overlooked also that other factors summed up in the expressions "well-rounded diet" and "good physiologic states" play a part. For example, a well-

10. Sherman, H. C.: Food and Health, New York City: Macmillan Co., 1934, pp. 156-157.

rounded diet would include not only sufficient amounts of calcium and phosphorus, but also foods to supply the caloric and maintenance requirements, such as carbohydrates, fats and proteins; mineral salts, such as sodium chloride, and the others prominently mentioned, water, etc. Under good functioning would come proper digestion, absorption and glandular interplay.

There is no direct positive evidence from either the laboratory or the clinics that the addition of calcium and phosphorus compounds to an otherwise ample diet influences in any marked fashion the incidence of dental decay in the child or the adult; or that it promotes the development of noncarious teeth *in utero,* in infancy and during growth or in the adult; nor is there any sound evidence that a calcium drain during pregnancy and lactation is lessened by the addition of these compounds when the diet is well-planned. On the contrary, there is evidence that such medication is unnecessary.

Rickets is recognized as a clinical manifestation of unsatisfactory calcium utilization. Hence, it has been assumed that caries is a concomitant of rickets. Hess, a careful student of the rickets problem, pointed out[11] that young children who had been protected from rickets developed less caries than those who had not been protected. This evidence was by no means conclusive, as he found numerous instances of dental caries in the nonrachitic group. Considerable caries was likewise observed in the teeth of a group of children who had been breast fed and who had shown no evidence of rickets. These findings have only an indirect bearing on the simple problem of calcium and caries, but they illustrate the difficulties attendant on consideration of the problem and force the conclusion that caries is not caused by any known single condition. That the calcium content of the teeth is not a significant factor was pointed out years ago by Black.[12] He found that carious teeth had as great a lime content as those that showed slight caries; but, as will be shown later, these results are in dispute as far as structure and incidence of caries is concerned.

May Mellanby, who has been one of the most active proponents of the effects of diets rich in vitamin D, points out the following, which bears on the problem under discussion: "We do not even know the amount of calcium and phosphorus required in relation to vitamin D during the different period of growth nor the form in which they are most readily absorbed and utilized." While Mellanby stresses the D factor, it is worth noting that, in her cases, protection against hypoplastic enamel both of dogs and of children was brought about by ingestion of substances containing much of the fat soluble vitamins, as well as calcium and phosphorus, such as milk, egg yolk, fish and animal fat, and in no case where protection was secured was it necessary to add mineral supplements of calcium and phosphorus. It is conceded that vitamin D is desirable at all stages, not because of a *specific* influence on the caries factor or factors, but because of its calcium mobilizing features.

Boyd and Drain reported that dental caries could be arrested by diets that contained "mineral salts, and vitamins A, C and D." Of pertinent interest in the present connection is the following:

> It is worthy of special note that it has not been necessary to use mineral mixtures, such as are being exploited as therapeutic dietary accessories, to supplement the mineral content of these diets. Apparently, the essential minerals have been supplied in adequate amounts by the use of menus which were simple in nature and readily obtainable.[13]

Similar results were obtained by Bunting.[14] All of these represent confirmation of the earlier experiments of Howe on monkeys in that protection was secured by "ample

11. Hess, A. F., and Abramson, Harold: D. Cosmos, 73:849 (Sept.) 1931.
12. Black, G. V.: D. Cosmos, 37:353 (May) 1895.
13. Boyd, J. D.; Drain, C. L., and Nelson, Martha V.: Am. J. Dis. Child., 38:721 (Oct.) 1929.
14. Bunting, R. W.: Am. J. Dis. Child., 40:536 (Sept.) 1930. McBeath, E. C.: J. D. Res., 12:723 (Oct.) 1932. Schoenthal, L., and Brodsky, R. H.: Am. J. Dis. Child., 46:91 (July) 1933.

diets." It is significant to note that improvement of the diet is stressed by all investigators who found improvement in the caries picture; and that all did not find necessary or even desirable the addition of calcium and phosphorus. Regardless of the specific ascribed factors in the benefit observed, the concordance is of interest in relating improvement to general well-being.

LEVELS OF CALCIUM AND PHOSPHORUS IN SERUM AND SALIVA AND RELATION TO CARIES

In a given individual, under physiologic conditions, the serum calcium content is extremely constant. During the terminal months of pregnancy, the serum calcium shows a slight tendency to be subnormal, presumably because of the calcium required by the fetus. The latter statement must be accepted with reservation as will become apparent in the discussion of the results of Hess, described in the section under pregnancy.

The present evidence regarding the calcium level of serum as regards caries at almost any period of life indicates that there is no confirmed relationship between the levels of calcium and inorganic phosphorus in serum and the occurrence of caries. Evidence in support of this view is found in the work of Schoenthal and Brodsky[15]; Karshan, Krasnow and Krejci,[16] and Boyd, Drain and Stearns.[17]

As the saliva has not been the subject of such exhaustive investigation, it should not be surprising that the theories regarding it are not so definite as in the case of blood. Nevertheless, data concordant enough to permit conclusions are available. Entin[18] concluded that the influence of inorganic phosphorus in saliva on caries formation is insignificant. In a group of children from 7 to 16 years old fed on a diet supplemented by the daily addition of a quart of milk and 2 ounces of tomato juice, with or without viosterol in oil, Hubbell and Bunting[19] found that improvement was not accompanied by any consistent change in the salivary calcium and phosphorus content, nor could Boyd, Drain and Stearns[20] find any correlation between the saliva of affected and nonaffected groups. Karshan, Krasnow and Krejci found similar results, but point out that the phosphorus content of saliva was higher in immune mouths than in susceptible. These differences may lack significance in view of the overlapping of so many individual values. Thus, one may conclude that neither the serum nor the salivary calcium and phosphorus are of striking importance as far as caries is concerned.

CARIES AND PREGNANCY

Much is made of the value of calcium and phosphorus combinations for preventing dental caries during pregnancy and for insuring an adequate calcium content for the baby, and thus protecting it against caries. The evidence does not support the claims that addition of these mineral supplements is necessary or even desirable provided the diet is well regulated and the rules of oral hygiene are observed.

The evidence in favor of administration of calcium compounds is not of such nature as to warrant the claims that supplies of calcium or of phosphorus supplemental to that obtained by diet are necessary. Toverud,[21] in 1927, reported a noticeable difference in the microscopic appearance and chemical composition of rats from mothers whose diet was deficient in calcium. These results were essentially confirmed by Macomber,[22] but it is interesting to note, in both cases, that the diet was extremely low in calcium, and both authors pointed out the desirability of having a diet high in calcium. Although ap-

15. Footnote 14, third reference.
16. Karshan, Maxwell; Krasnow, Frances, and Krejci, Laura E.: J. D. Res., 11:573 (Aug.) 1931.
17. Boyd, J. D.; Drain, C. L., and Stearns, G.: J. Biol. Chem., 103:327 (Dec.) 1933.
18. Entin, A.: Deutsche Monatschr. f. Zahnheilk., 28:867, 1928; Chem. Abstr., 24:5831, 1930.
19. Bunting, R. W., and Hubbell, R. B.: J. Nutrition, 5:599 (Nov.) 1932.
20. Footnote 17, p. 330.
21. Toverud, Guttorm: Chem. Abstr., 21:2506, 1927; D. Cosmos, 44:1213 (Dec.) 1927.
22. Macomber, Donald: J.A.M.A., 88:6 (Jan. 1) 1927.

parently this differs from Black's earlier views, there does not appear to be a real conflict, for Black used teeth from human beings. More direct evidence of a convincing nature comes from the observations of the late Alfred F. Hess. In a roentgenographic and chemical study of the teeth of infants[23] from birth onward, Hess concluded *inter alia:* 1. Calcification must be regarded as a postnatal phenomenon. 2. At birth, only 0.5 gm. of tricalcium phosphate $[Ca_3(PO_4)_2]$ had been laid down in the teeth of both jaws. 3. As far as the teeth of the infant are concerned, it cannot be of great moment whether throughout pregnancy a woman have a diet high in calcium and phosphorus. She is provided with a bounteous storehouse of these substances in the bony skeleton, from which, with the greatest facility and without the slightest harm to the prospective mother, the 0.5 gm. required for the denture of the fetus can be withdrawn. 4. The postnatal period is of great significance as regards calcium and phosphorus requirements for teeth. 5. Infants admitted to the institution in which these studies were made during the first years of life, when the crowns undergo almost complete calcification, develop less caries than those admitted during their second and third years. 6. Little is to be gained by increasing the calcium and phosphorus intake of the expectant mother.

This leaves open the question of the effect of pregnancy. Later investigations do not support the old and commonly held view expressed by the dictum, "for every child a tooth," at least as far as pregnancy is concerned. Ziskin's investigations[24] do not demonstrate this. Mull, Bill and Kinney,[25] who studied the blood and teeth of a large series of pregnant women, conclude: "There is no appreciable change in the teeth of women during pregnancy or the first weeks of lactation other than that which would probably occur in a similar group of nonpregnant women during the same period of time. The levels of the calcium and the inorganic phosphorus of the serum of the pregnant women bear no direct relation to the condition of her teeth." Unfortunately, these authors were not able to follow their cases beyond the first few days of lactation.

It is known that the calcium requirements of nursing mothers are high. In another direction, Albright, Aub and Bauer[26] found, in marked cases of hyperparathyroidism, that the loss of calcium from bones is great, while the teeth themselves remain intact. In these instances, at least, the teeth did not share in the rapid biochemical changes as did the bones.

Hunscher[27] determined that negative calcium and phosphorus balances were found in early lactation in spite of large intakes of these elements, but, in late lactation, when less milk was secreted, both calcium and phosphorus were stored in the maternal body. Macy and others[28] found, in addition, that daily feeding of cod liver oil and yeast during the highest period of milk flow resulted in greater calcium and phosphorus utilization. No notation is made concerning the effect on teeth. The foregoing is interesting nevertheless in pointing out that not calcium or phosphorus alone but vitamin D is important. This would appear to warrant the conclusion that not the absolute amounts of calcium and phosphorus, but those materials on which they are dependent for fixation are important. In this connection, the following comment of Aub in the article "Parathyroid Hormone Therapy," as illustrating the use of milk for such calcium-depleted states, is of interest:

> Pregnancy with lactation has great effects on the calcium stream in the body. This was dramatically demonstrated by the observations of Kozelka, Hart and Bohstedt in which they showed that adult thyroparathyroidectomized dogs lived satisfactorily when given 13 rat units of vitamin D daily until they became pregnant. Their requirements for vitamin D to prevent tetany then gradually rose to 26,000 units and during lactation to more than 40,000 units daily.

23. Hess, A. F.; Lewis, J. M., and Roman, Benjamin: D. Cosmos, 74:1053 (Nov.) 1932.
24. Ziskin, D. E.: Am. J. Obst. & Gynec., 12:710 (Nov.) 1926.
25. Mull, J. W; Bill, A. H., and Kinney, F. M.: Am. J. Obst. & Gynec., 27:679 (May) 1934.
26. Albright, F.; Aub, J. C., and Bauer, W.: J.A.M.A., 102:1276 (April 21) 1934.
27. Hunscher, Helen A.: J. Biol. Chem., 86:55 (March) 1930.
28. Macy, Icie G., et al.: J. Biol. Chem. 86:59 (March) 1930.

It is not difficult, therefore, to understand the appearance of tetany and the bodily need for high calcium therapy and its adjuncts during this period. In a prolonged demand such as this, the control of tetany can usually be accomplished by the wise use of adequate amounts of milk and vitamin D. Only rarely will the more urgent treatment of tetany, already described, be needed.[29]

In a review of the caries problem, the following statement of MacPhee[30] tersely presents an apology for the indiscriminate calcium administration: "The mere feeding of excessive calcium to a normal individual will therefore not have any effect, but when calcium deficiency is suspected or proved, calcium therapy may be of value. It would therefore appear better to be on the safe side and rather have too much than too little calcium in the diet." This is medication on too haphazard a basis. The danger of medicating on such a basis is the false sense of security that generally arises. It would be unfortunate if, in view of the absence of carefully controlled evidence that compounds of calcium and phosphorus are prophylactic against or arrestive in dental caries, use of these compounds should be universally encouraged by the dental profession. It should not be denied that there might be conditions (during lactation or periods of rapid growth) wherein a real calcium deficiency would render such medication legitimate, but such additions should not be indulged in indiscriminately unless there is a real need.

CONCLUSIONS

Calcium and phosphorus are essential elements of the diet.

All the calcium and phosphorus requirements for average needs, including pregnancy and growth, may be suitably obtained by means of an adequate diet containing not only calcium and phosphorus compounds, but also other necessary factors, such as caloric requirements, protein and other mineral and vitamin requirements.

There is no carefully controlled evidence that the addition of calcium and phosphorus compounds, whether inorganic or organic, promote retention of these elements and hence freedom from dental diseases, except in known cases of deficiency. Where this occurs, milk serves as an excellent source of calcium and phosphorus in a readily assimilable form.

In such rare conditions as osteomalacia, parathyroid tetany and some of the conditions of pregnancy, which may require it, additional calcium can be supplied by such simple compounds as the chloride, lactate, gluconate and possibly tricalcium phosphate. But the administration of these does not overcome the cause. These conditions may require medication with parathyroid extract or vitamin D.

There is no evidence that the ingestion of calcium-phosphorus combinations in addition to diets adequate in these elements promotes the development of sound teeth in the human fetus. The calcification of the teeth is a postnatal event.

Finally, the following statements of Rosebury[31] may be emphasized:

The reparative treatment of dental caries, based on the principle of local susceptibility, depending on dental conformation and natural hygiene, is invariably successful when properly practiced, in that dental caries does not recur under or at the margins of properly treated and filled cavities. Hygienic measures as now applied are probably of definite but limited value in combating caries. *Empirical prophylaxis by regulation of the diet of children is distinctly effective, and, at least until the problem becomes more fully understood, deserves more universal adoption.*

In other words, dentists should apply the newer knowledge of nutrition as far as it is sound, but they should not overlook the part that operative dentistry plays in the arresting of the caries process.

29. Aub, J. C.: Parathyroid Hormone Therapy (Series of Special Articles on Glandular Physiology and Therapy, J.A.M.A., 105:197 (July 20) 1935.

30. MacPhee, G. G.: Studies in the Etiology of Dental Caries, London: John Bale, Sons, and Danielsson, Ltd., 1935, p. 43.

31. Rosebury, Theodor: Problem of Dental Caries, Arch. Path., 15:260-278 (Feb.) 1933.

BUREAU OF PUBLIC RELATIONS

ARE YOU PREPARED TO MEET THE CHILDREN?*

By H. SHIRLEY DWYER, D.D.S., Brooklyn, N. Y.

ARE we prepared to meet the children? I propose to discuss this subject of dental preparedness under the headings of: 1. What we do not know. 2. Why we do not know. 3. Some things we should know.

WHAT WE DO NOT KNOW

A little honest self-analysis will probably reveal quite an extensive list under the heading: What We Do Not Know. In the various alphabetical government projects designed to alleviate the distress of some of our confrères, it has been possible to observe dentists of all ages and degrees of skill and to learn many of the shortcomings of the dental educational system relative to dentistry for children.

May I pause to pay tribute to the men of the profession who have passed under my supervision for their willingness to learn and their adaptability in new and sometimes trying environment.

On the basis of this more or less intimate knowledge of the work and difficulties of the average private practitioner who is suddenly called on to devote a great deal of his time to working for children, I would point out four outstanding deficiencies in our knowledge. They concern (1) child psychology, (2) the anatomy of the deciduous teeth, (3) cavity preparation in deciduous teeth and (4) the value of preventive dental operations. These points will be discussed in the order named.

We who stand at the side of the chair have an exceptional opportunity to apply the principles of practical psychology. Yet a lack of knowledge of the proper approach to the child, of what to do for the willfully disobedient child; when to be severe and when to play; how to inspire confidence, and how to eliminate fear—all of these deficiencies and many more are bogies to the dentist just starting a children's practice. Have we ever been taught these things or must we depend on a continuous trial and error method of learning in child psychology? It has been my observation that, in many cases, on the first visit of a child to the dentist, the dentist is actually more afraid of the encounter than is the patient. A lack of familiarity with just the simplest principles of child guidance is the reason.

Even though psychology does not appear as a major subject in dental school catalogs, dental anatomy does. And yet how many of us have had the misfortune to be preparing a step cavity in a deciduous molar only to suddenly find that little tell-tale drop of blood? That, of course, was during our trial and error period of learning the dental anatomy of the deciduous teeth. Approximately how deeply can we cut mesially or distally into

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a deciduous molar without getting into difficulties? Is the dentin of deciduous teeth more permeable than that of permanent teeth? A knowledge of dental anatomy would tell us these things.

The subjects of dental anatomy and cavity preparation are so closely allied that a knowledge of the first is necessary to a practice of the second. A knowledge of cavity preparation alone may eliminate the annoyance of having compound amalgam fillings in deciduous teeth fracture at the marginal ridge, and this does happen in the best offices. It might also help us to answer the question as to what to do for incisors that have been in too forceful contact with drinking fountains.

In considering operative preventive measures, apparently there is not so much a lack of knowledge as the fact that these measures are too little understood and less practiced by many otherwise capable dentists. To such men, it is always a revelation when we absolutely insist in clinic work that all pits and fissures must be prepared and filled. Sometimes, it seems unfortunate that every practicing dentist does not have to spend a certain amount of time each year in a well supervised service. Proper supervision of his work is constructive and inspirational to any man and it cannot be objected to by any one who is not afraid to have his work identified as a product of his skill.

If, as has been said, there are four outstanding deficiencies in the average dental knowledge, what is the reason for this lack?

WHY WE DO NOT KNOW

How many dental schools or dental societies give instruction in applied psychology in class, as postgraduate work or at scientific meetings? Everyone of us should at least be made familiar with some of the elements of psychology, and something of teaching methods. Both are necessary to the successful fulfilment of our duties in our offices. I would suggest to any society officers who may be present that they try having at least one paper a year presented by some qualified, practical psychologist on the psychology of fear; or child psychology; or a psychologic approach to the patient. We are sadly lacking in training along these lines, and we need it. We are likewise left untutored in the matter of presenting information to the public in such a way that the lay person, either child or adult, will remember and practice what we have taught them. If you desire a lasting practice, base it on what you can teach the patient—not on what you can charge him.

Why, also, are we so unfamiliar with the anatomy of the deciduous teeth? I answer that question with another: How many of us ever carved, drew, or sliced a deciduous tooth while at school? Only very recently, the head of the operative dentistry department of one of our universities said that he could see no reason for modifying cavity preparation in deciduous teeth as their anatomy was the same as that of the permanent teeth. How much space in our textbooks is devoted to the deciduous teeth? In one dental anatomy, nine pages out of 169 are given to the consideration of the deciduous dentition. In another, we find very much less, and this is a more recent publication. It is interesting to note that the older of the two books gives the more complete description of the deciduous teeth and emphasizes the fact that there are anatomic differences between the two dentitions.

We then turn hopefully to the pages of an excellent textbook on pedodontia. Here we find six or seven pages of practical advice on cavity preparation and, in the entire book, just one sentence which merely points out that it is due

to a difference in anatomic structure that we must modify Black's cavity preparation. It is known that a new book on pedodontia is about to make its debut. Let us pray that this new author will give the proper space and weight to a thorough discussion of the anatomy of the deciduous teeth and that his suggestions for cavity preparation may be based on understandable facts and therefore more easily remembered and carried out.

If we can find so little help in our textbooks on the anatomy of the deciduous teeth, it is not surprising to find an even greater lack of information relative to cavity preparation. True, our all too few books on pedodontia carry suggested modifications of standard procedures, but why leave this out of our standard works on operative dentistry? In questioning more than 150 recent (1933-1934) graduates, I found that not one could give me the name of a textbook on pedodontia. Where, then, could they acquire the necessary knowledge of cavity preparation for deciduous teeth, when, as we know, it did not exist in their standard operative dentistry text? Is it fair to the child patient that we send out graduates to use a trial and error method of learning the details of cavity preparation in deciduous teeth? Is there no place in the college curriculum for this subject? Why should the dental schools be behind the times in what they are teaching? We expect a prospective teacher of elementary school children to go through a normal school in which she will be taught how to teach. A teacher in a secondary school must have gone through college and then qualified in an examination showing her ability to teach. Does the instructor in a dental college have to pass an examination to show his ability to teach? We are attempting to fit young men for a professional career. Many of these students today have a broader educational background than their instructors, yet no knowledge of even the simplest principles of teaching must needs be demonstrated before one can become an instructor. That he knows his subject is no reason that a man can convey that knowledge to a class. Some may have the ability naturally, but all should be trained in its use. Is there really any good reason that an instructor in college should not have to prove his ability to teach just as does the instructor in an elementary school?

As to the value of preventive dental operations, it has been my experience that this lack of knowledge is most frequent among older practitioners, who have failed to keep abreast of dental advances and to whom Hyatt's teachings have been as a voice crying in the wilderness.

SOME THINGS WE SHOULD KNOW

The application of a knowledge of child psychology is largely the application of common sense when dealing with children. If we greeted a young woman patient of 20 or so with: "So this is my little sweetheart Mary that Mamma has been telling me all about. Now don't be frightened, but just let me see your little teeth. I won't hurt you a bit," and then seized a second permanent molar and proceeded to twist it out of its socket without the use of any anesthetic, where would we find ourselves? Offhand, I should say either in the insane asylum or the court of domestic relations. We would not think of doing such a thing. Then why perpetrate that sort of thing on a young lady of 5 any more than on the debutante of 20? Let us try to place ourselves in the child's position. "We must discard the grown-up glasses of a muddled maturity if we would see as does the child." This does not mean a patronizing attitude. We know how quickly we get a cramp in the neck when

we have to gaze upward for any length of time at some tall building. If we raise ourselves so far above the child's plane of perception, we are just a pain in the neck to *him*.

Greet the child patient in a quiet sensible manner. The more ado we make over the entrance of the child into the office, the more reason he has to suspect our motives. If we have confidence in ourselves and our ability to cope with juvenile situations, let us show it. Let us make it quite plain from our bearing and words that this is just an everyday occurrence; that we expect Bill to walk in and get up in the chair when we ask him to, without any fuss. Why is it that so many dentists have remarked: "What good children you have in this clinic! I wish they would be like that in my office." This is largely because the clinic operator has no time to waste, so he casually invites the child to come in, and then goes about his work in a business-like manner, thereby inspiring confidence in the child. The abnormal child calls for unusual treatment; the frightened child must be won over, and the willful spoiled child must be put in his place and made to understand that we are in command of the situation. Yet all of this can be accomplished quietly, and as much by our actions and bearing as by any words.

A child's name is very important to him. He is Richard, not just "Sonny." If we have equipped ourselves with a little information about his likes and dislikes, we are prepared to carry on an intelligent and interesting conversation, which probably more than any other thing tends to quiet the nervous child. These simple little facts are easily obtained from the parent before the child is introduced. Many of us today make inquiries through credit investigators as to the paying habits of new patients, an excellent plan. Then why not make a few inquiries as to the talking habits of our child patients? The mother will be delighted to furnish the necessary information and at the same time will be subtly flattered to find the dentist taking such a personal interest in her child. One more little point that may help us over some of the rough spots: Let us try to keep the youngster occupied. Almost all children wish to help. It is the natural instinct of learning through "doing." One of the fundamental principles of teaching is that precepts alone are not sufficient: a child wants to do a thing, as well as hear about it. We can utilize this instinctive desire to our advantage. The child patient will not be nearly so restless if she is holding one end of the cotton roll. Incidentally, she has to wash her hands before she can help, thereby learning another lesson. Most of the children help me mix the amalgam by holding the end of the pestle while the alloy is being amalgamated. No harm is done, no time is sacrificed and the child is kept occupied. Try occupational therapy for mischievous fingers. The best and surest way of keeping a child from doing a thing is to give him something else to do. Then we are positive in our position rather than negative. One point must ever be borne in mind: We are master of the situation or else there can be no dental work for the child in our office.

May I make the suggestion that any one interested in hearing a practical application of child psychology would do well to listen, critically, to one of radio's child favorites, Uncle Don.

Under the heading of dental anatomy, as well as that of cavity preparation, space in a paper of this type does not permit the detail necessary. Each subject could be dealt with as a separate topic, and should receive the time of a full scientific exposition. Just a few suggestions may be in order:

At your earliest convenience, I suggest that you mount a few deciduous teeth horizontally in plaster blocks, then grind them into longitudinal sections. Next do the same thing, but this time make cross sections. In similar blocks, mount corresponding permanent teeth and section them the same way. Now look for the following points of comparison between the deciduous and permanent teeth:

On the longitudinal sections:

1. Size of pulp chamber as related to size of coronal portion of tooth.

2. Distance at neck of tooth from periphery of tooth to pulpal wall.

3. Distance of pulp from vertical line drawn from the dentino-enamel junction at neck of tooth through occlusal surface. Where is it closest?

4. Distance between coronal periphery and pulpal wall at neck of tooth and at occlusal surface (determined with calipers). How does this compare with the same points on the permanent teeth?

5. Gingival border of enamel cap, especially in deciduous lower first molars and permanent teeth.

If any of these mounted specimens show root resorption, it might be of interest to note the relationship between root canal and resorbed root periphery. How many root canal points would go to the apex, and how many would find an easier exit at the site of resorption? Now check this last sectioning with some of the roentgenograms showing similar conditions actually in the mouth.

Cross section blocks:

1. Comparative size of pulp chambers. Let the first section be made across the middle third of the crown. Compare the thickness of the peripheral wall to the thickness of a dime or a No. 34 inverted cone bur.

2. Mesial surface outline of second deciduous molar and distal outline of first deciduous molar.

3. Foregoing and permanent molars; effect on cavity outline.

4. Cross section just occlusally from cemento-enamel junction. Taking the same dime and No. 34 inverted cone bur, once more compare the thickness of structure overlying the pulp.

Purposely, the answers to the foregoing observations will not be given here. Earlier in this paper, I said that "Precepts alone are not sufficient." It is my desire to arouse your interest in doing these things. Try them to see whether your present impressions coincide with the actual facts.

From anatomic form, to cavity outline is a natural progression. On what do we lay down rules for cavity preparation? Certain principles of engineering adapted to fit the varying conditions of caries extent and limited by the anatomic structure. If we accept this statement, we must revert once more to anatomy to help us solve the problem of cavity preparation in deciduous teeth.

Our anatomic observations having demonstrated the relatively greater occlusal protection afforded the pulp in the deciduous teeth, we can readily understand why this part of a Class II cavity can be much deeper than either the mesial or distal portions. In order to keep the mesial or distal portions of sufficient shallowness, that we shall not impinge on pulpal horns, and yet give sufficient bulk over the marginal ridge that the amalgam will not fracture, it is necessary to begin the proximal flare of the cavity well back from the step. A glance at the cross section already made will quickly demonstrate this. I shall speak of this flare because it is well to bear in mind the fact that cavity margins, in the deciduous teeth especially, should be brought well out from the interproximal embrasure.

Of late, there has been much discussion

pro and con regarding slice preparation inlays and box preparations and the relative value of inlays over amalgam fillings in deciduous teeth. These questions are readily answered by consideration of the longitudinal sections previously mentioned. Looking at one of these longitudinal sections of a deciduous molar, let us ask ourselves which will give the greatest pulpal protection. Will it be the square type of cavity preparation, as for amalgam, or the slice preparation, for the Willett type of inlay? A pencil line on the sectioned tooth will answer this much more graphically than I could. In other words, before we can make a decision one way or the other about the matter of what is most applicable in a given situation, let us obtain a good working knowledge of the anatomy of the deciduous teeth. It would seem only logical to look before we cut.

Before leaving this topic of anatomy and cavity preparation, there is a suggestion that I would like to make: It is that this Section and every other organization interested in the very vital subject of dentistry for children bring official pressure to bear on our institutions of learning that they give a practical course in pedodontia. This does not mean one of these courses that are confined to an announcement in the prospectus, but a practical course in which the student has to do the work. I again say, "Precepts alone are not sufficient."

There remains little to be said relative to the value of preventive operative measures other than to recommend to your attention the writings of Dr. Hyatt. Certainly one of the simplest, most effective operations at the command of the dentist is prophylactic odontotomy. There is just one idea relative to this procedure which we must ever bear in mind: A pit or fissure in a groove must be considered as an indicator rather than just an unrelated defect of the enamel. It is an indication that that particular groove has not properly coalesced, and therefore should be cut out and filled. If one visible point in the groove is not properly enameled, how do we know there are not invisible defects along the same groove? Let us therefore take the presence of a pit or fissure in a groove as sufficient indication that that groove must be placed in a condition which will render it impervious to future attacks of caries. It has been very aptly said: "The enamel defect of today is the carious cavity of tomorrow."

If only we can keep before us the ideal of a preventive dental service as far, far superior to any restorative substitute, we shall be much better prepared to meet the children.

BUREAU of PUBLIC RELATIONS + AMERICAN DENTAL ASSOCIATION + 212 E. SUPERIOR ST., CHICAGO, ILL.

Children's Dental Record Card

NAME (LAST) (FIRST)

☐ MALE ☐ FEMALE — DATE OF BIRTH — PLACE OF BIRTH

CITY OR COUNTY — STATE

HISTORY GIVEN BY — 1.☐ PARENT 2.☐ CHILD 3.☐ NURSE

NATIVITY { FATHER / MOTHER

RACE ☐ WHITE ☐ BROWN ☐ YELLOW ☐ RED ☐ BLACK ☐ MIXED

SCHOOL ☐ PUBLIC ☐ PRIVATE ☐ PAROCHIAL ☐ INSTITUTIONAL

EXAMINATION BY + PURPOSE OF
1. DENTIST 1. RESEARCH
2. HYGIENIST 2. PRIVATE PRACTICE
3. DENTAL STUDENT 3. HOSPITAL
4. PHYSICIAN 4. SCHOOL CLINIC
5. NURSE 5. DETACHED CLINIC
6. TEACHER 6. SURVEY

DATE OF EXAMINATION									
AGE OF CHILD									
SCHOOL GRADE	KIND.	1	2	3	4	5	6	7	8
SCHOOL PROGRESS									
1. EXCELLENT									
2. NORMAL									
3. POOR									
4. RETARDED									
TEMPERAMENT									
1. NORMAL									
2. NERVOUS									
3. PHLEGMATIC									
PHYSICAL HISTORY									
HEIGHT									
1. NORMAL WEIGHT									
2. UNDER WEIGHT									
3. OVER WEIGHT									
4. GOOD POSTURE									
5. POOR POSTURE									
6. ADENOIDS + IN +									
7. ADENOIDS + OUT +									
8. TONSILS + IN									
9. TONSILS + OUT									
10. TONSILS + LARGE									
11. SPEECH NORMAL									
12. SPEECH DEFECT									
INFANT FEED									
BREAST FED — NUMBER OF MONTHS									
BOTTLE FED — NUMBER OF MONTHS									
DIETARY HISTORY									
1. MILK									
2. FRUITS									
3. VEGETABLES									
4. WHOLE GRAIN									
5. MEAT + EGGS									
6. COARSE FOOD									
7. SUN BATHS									
8. VITAMIN D									
9. EXCESS SWEETS									
HOME CARE									
1. REGULAR									
2. OCCASIONAL									
3. NONE									
DENTAL CARE									
1. REGULAR									
2. OCCASIONAL									
3. NONE									

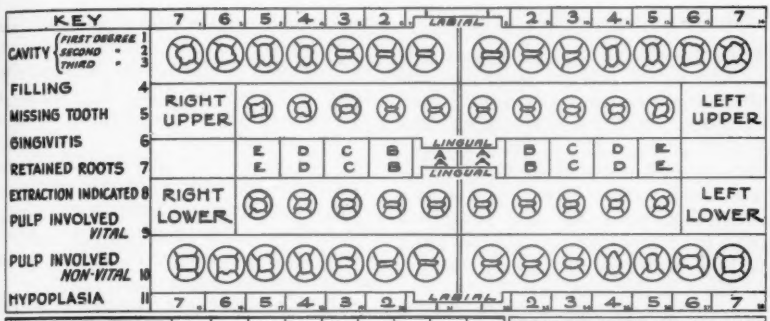
SIG. SIG. SIG. SIG. SIG. SIG. SIG. SIG. SIG. SIG.

DISEASES	AGE
1.☐ MEASLES	
2.☐ WHOOPINGCOUGH	
3.☐ CHICKENPOX	

DISEASES	AGE
4.☐ SCARLET FEVER	
5.☐ DIPHTHERIA	
6.☐ TYPHOID FEVER	

DISEASES	AGE
7.☐ MUMPS	
8.☐ INFANTILE PAR.	
9.☐ RICKETS	

REMARKS:



		KIND	1	2	3	4	5	6	7	8
DATE OF EXAM.										
AGE OF CHILD										
SCHOOL GRADE										
CAVITIES	DEC.									
	PER.									
FILLINGS	DEC.									
	PER.									
MISSING TEETH	DEC.									
	PER.									
EXTRACTION INDICATED	DEC.									
	PER.									
FIRST PERMANENT MOLAR	UNERUPTED									
	DECAYED									
	EXTRACTED									
	O.K.									
GINGIVITIS	DEC.									
	PER.									
ORAL HYGIENE	GOOD									
	FAIR									
	POOR									
PROPHYL NEEDED										
OCCLUSION: IRREGULAR										
OCCLUSION: OVER BITE										
OCCLUSION: OPEN BITE										
OCCLUSION: CROSS BITE										
OCCLUSION: LOWER RETRUSION										
OCCLUSION: LOWER PROTRUSION										
OCCLUSION: UPPER PROTRUSION										
HABITS: THUMB SUCKING										
HABITS: FINGER SUCKING										
HABITS: MOUTH BREATHING										
HABITS: LIP BITING										
HABITS: TONGUE BITING										
HABITS: CHEEK BITING										
HABITS: RESTING ON HAND										
HABITS: SLEEPING ON HAND										
HABITS: PACIFIER										

RECORD OF OTHER FINDINGS

TEETH LOCATED BY ROENTGENOGRAMS

SUPERNUMERARY TEETH

REMARKS:

EXAMINED BY:

KIND.
1st
2nd
3rd
4th
5th
6th
7th
8th

TYPE OF EXAMINATION

① GOOD LIGHT. TEETH FREE FROM DEBRIS AND DEPOSITS. DRY TOOTH SURFACES. MAGNIFICATION BY BINOCULAR LUPE. EXPLORER, POINTS OF 35 GUAGE OR LESS. INTERPROXIMAL ROENTGENOGRAMS. ② SAME AS TYPE ① EXCEPT FOR ABSENCE OF BINOCULAR LUPE AND ROENTGENOGRAMS. ③ GOOD LIGHT. EITHER OR ALL OF THE FOLLOWING: MOUTH MIRRORS; TONGUE DEPRESSORS; EXPLORERS

CHECK TYPE OF EXAMINATION HERE. KIND 1 2 3 4 5 6 7 8

INSTRUCTIONS: USE DIFFERENT COLORED INK EACH YEAR.

CAVITIES: 1ST. DEGREE INVOLVES ENAMEL 2ND DEGREE + DENTIN 3RD DEGREE + PULP

ANY SECTION OF CHART NOT USED SHOULD BE MARKED N.A.

ROOTS ARE CONSIDERED AS TEETH PRESENT

MARK CAVITY OR FILLING BY PLACING KEY NO. ON TOOTH DIAGRAM

MARK OTHER CONDITIONS BY PLACING KEY NO. BELOW TOOTH

Children's Dental Record Card

The Rhobotham Children's Dental Record Chart on the adjacent pages is a copy of the recently revised dental record chart for children. A copy of the original chart appeared on page 346 of the February, 1934, issue of The Journal. Practical use of the original chart during the past two years demonstrated the need of certain changes in its construction and form. These have been made and the revised chart is now offered to the profession.

Printed on both sides of light 5 by 8 cardboard, the content of the new chart is less confusing and the chart itself is much less cumbersome than its predecessor. The family, medical, school and dietary history are tabulated on one side of the chart by the dental assistant, nurse, teacher or hygienist. The dental history is recorded on the reverse side of the chart by the dentist or the assistant.

Provision has been made to keep a detailed dental record of the child for nine years, or from kindergarten through the eighth grade. Thus, the dentist or the school authorities can have a comparative record of the child's dental condition from year to year.

This chart is one of the last contributions of the late F. Blaine Rhobotham to children's dentistry. Its universal adoption by the profession and schools will result in a standardization of examinations and tabulations of children's dental conditions. It bears the approval of the Dental Health Educational Committee of the A.D.A. and of the American Society for the Promotion of Children's Dentistry.

Distributed by the Bureau of Public Relations, A.D.A., at 75 cents a hundred. Prices on lots of 1,000 or more on request.

Pennsylvania Dental Division Reestablished

November 15, the dental division of the Pennsylvania department of health was reestablished. Milton I. Wass, D.D.S., of Philadelphia has been appointed chief of the division. Pennsylvania has long been a leading state in promoting preventive dentistry and the profession greatly deplored the fact that economic conditions necessitated the discontinuance of their dental health program during the depression.

Dental Film on Traumatic Avulsion of Maxilla*

Oct. 28, 1935, the Secretary of the American Dental Association received the following letter from the secretary of the San Antonio Dental Society:

"Under the direction of the Board of Officers of the San Antonio Dental Society, and with the compliments of its members, I am forwarding, under separate cover, a 16 mm. film entitled: 'Traumatic Avulsion of the Entire Maxilla with Lacerations of the Face.'

"This film pictures a very unusual case and I feel certain that it will be of interest to you and the members of the American Dental Association. It is the desire of the San Antonio Dental Society that this film be placed in the Library of the Association for future use of and reference by its members.

"This film was produced by Franz Wilhelm Stumpf, of this city, a member of our local society, in the Department of Oral Surgery, Robert B. Green Memorial Hospital, of which Dr. Stumpf is one of the chiefs of the Service.

"Trusting this little gitt will be of interest to the American Dental Association and yourself and with the kindest personal regards, I am

Yours truly,

(signed) Leslie D. Maurer, *Secretary*"

Thanks are expressed to the San Antonio Dental Society for this valuable contribution to the A.D.A. film library. Other dental societies wishing to borrow this interesting 100

*For report of case, see Stumpf, F. W.: Laceration of Face with Traumatic Avulsion of Entire Maxilla, J.A.D.A., 22:1206 (July) 1935.

feet of film may do so by writing the Bureau of Public Relations, American Dental Association.

Radio Talks

Are *you* guilty of using *stale radio material?* Stop dusting off old radio talks, and *take advantage* of twenty-five *new 7-minute broadcasts,* recently compiled by the Bureau of Public Relations of the American Dental Association.

This new series bears the endorsement of both the American Dental Association and the United States Public Health Service.

Do your part by *broadcasting* such helpful information as:

1. How to Build Good Teeth for Your Child
2. What Dental Decay May Cause
3. The Dental Needs of the Child
4. The Prevention of Crooked Teeth
5. The Prevention of Dental Decay
6. The Mouth—The Gateway to Health
7. Dental Treatment of the Expectant Mother
8. Deciduous (Baby) Teeth
9. The First Permanent Molars
10. The Permanent Teeth
11. When Shall I Take My Child to the Dentist?
12. Mouth Hygiene
13. Tartar
14. X-Rays
15. Pyorrhea
16. Trench Mouth
17. Abscessed Teeth
18. Your Teeth and Personal Appearance
19. The Teeth an Indication of One's Habits
20. Care of the Gums
21. Tooth Troubles—The Result of Neglect
22. Diseases of the Soft Tissues of the Mouth (I)
23. Diseases of the Soft Tissues of the Mouth (II)
24. Some Thoughts on Prevention
25. The Extraction of Teeth

These talks sell for 5 cents a single copy, or 25 cents for six copies.

DENTAL ECONOMICS

ARE THE SCIENCE AND ART OF AMERICAN DENTISTRY TO BE SACRIFICED TO A FALSE PANACEA?*

By ARTHUR C. WHERRY, D.D.S., Salt Lake City, Utah

DURING the past year and one-half, the problems confronting dentistry have been very perplexing to me. I have had my convictions, but I have never had sufficient evidence to feel justified in my convictions.

In electing to go to Europe with Drs. Casto and Winter, I had in mind the satisfaction of my own conscience and the discovery of reasons for the beliefs that I had held.

I went not knowing but that this trip abroad would change my ideas regarding this much discussed and moot question of a program for insurance dentistry or panel dentistry or any other kind of system, be it by any name that any one may give to it, the compulsory system of exacting from the pay check of the worker of the lower bracket of income a portion of his weekly or monthly pay to be applied to building up funds for giving him and his family a health service.

On leaving home, I made the statement to a reporter that we were going to Europe to absorb those things which might be worth while in each system of insurance and, if it were a real benefit to humanity, to try to bring back to our country information regarding the best system obtainable.

That is the spirit in which I went abroad, and in traveling in the various countries—France, Belgium, Holland, England, Scotland and Ireland—we made some interesting observations.

We searched in and about the great metropolis of the British Empire. We went into Wales. We went to Scotland, through Ireland, from the North to South. If there was ever a man gifted by nature to delve into the secrets of the conditions in the countries where he travels, it is Dr. Casto. He was peculiarly gifted for the investigation that we were trying to make. I would not have the ingenuity to approach and enter into points and secure information in the manner that he was able to do it. He would approach the door of the humble, dirty slum home in one of these countries and in two minutes have the inhabitants of that hovel visiting with us, chatting about conditions and, before we left, answering the most intimate questions regarding how they were getting along and how they liked their government and the practices that were imposed upon them.

We went into the finest dental offices in Europe. We went into middle class dental offices of Europe. We went into lowly places called dental offices, but that are not, as we understand the term.

We did not want merely information as to how things were done among the persons who did not practice insurance

*Read at the Third General Meeting of the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

dentistry. We did not want to know just what the poorer class were doing. We wanted to know what the cross-section survey would indicate, and, mind you, we did not go to the health insurance departments of these countries to get our information, as many investigators who have gone over there have done, and who have come back with the propaganda that they were able to develop from the political henchmen who are bleeding the poor people whose money is taken away from them without their having anything to say about it.

We traveled in third class cars. We did not want to be lonesome and first-class cars are not very well filled, and the information could not be obtained so well there.

We discussed matters with the train crew, with our traveling associates of all strata, as to how they liked the health insurance program, what they thought of the standard of health service rendered them in both medicine and dentistry. We talked to bar maids in the cafes.

To understand this subject, it must be approached with humbleness. We must have an appreciation for the conditions of the day, as far as our national life is concerned.

Abraham Lincoln once said, in another great national crisis, "If we could know where we are and whither we are tending, we would know better what to do and how to do it." This is typical of our times. We must have reason. We must have logic. We must have facts, founded upon experience, if we are to arrive at a solution of our present problem.

If I differ with the viewpoint of some of my brothers here tonight, I want them to understand that my position and opinion are founded upon the facts as I see them.

I believe that dentistry is essential to the welfare and happiness of the human race, rich and poor, and I am interested in trying to find a method that will provide dental care for all classes. We are all united on the point that a greater percentage of the human family must have dental service, in order that the general health of the human family may be protected from the devastating results of neglect of oral conditions.

I am not attempting to stand in the way of progress. I am reporting on conditions that face our profession and the American people and I believe that we are attempting to solve the greatest problem that has ever confronted our profession.

I think the decision which our profession must arrive at soon is to be the most far-reaching decision in all the history of dental science. We cannot go on with strife and dissension, with different viewpoints, knifing each other, as has been the tendency. Unkind things have been said regarding men who have differed with others regarding health insurance, and we have been called reactionary and lacking in vision.

Fear stampedes people, and the effort to intimidate the men of our profession and threaten them has in some instances caused constituent dental groups to rush into programs that they are going to regret later on, and when once this program is started, it is much more difficult to get rid of it than can be imagined.

In Utah, certain "brain trusters," college professors, threatened that if we did not put a bill in the legislature which would provide health insurance, they would put it in for us. We told them to go ahead—that there was not a bill known to the wisest man in this country today that would stand the acid tests of reason, that we would rather shoot their bill full of holes than to make the mistake of showing weakness and putting a

bill of our own in. A bill was not put into the legislature because those men who thought they had a panacea for human illness could not develop a logical program.

The first thing to which I would call attention relative to the European program is that there is no provision for the indigent of those countries, and there are more indigent over there than this country ever dreamed of; but the compulsory insurance makes no attempt to provide dental service for the indigent. That is the thing that surprised me. I had no idea that the program was not comprehensive enough to take in all of God's children. It takes in only those people who have an income, those from whose pay check a certain portion can be extracted, without their having anything to say about it. Their funds are placed at the disposal of lay administrators, who are politicians, henchmen and welfare workers who want a life job, social reformers and what not.

I can prove to you the statements which I am making, and when you have the facts, you must judge of them and go home as the ambassador of American dentistry to tell the members of the profession at home why the American Medical Association defied even the administration at Washington on their program and why our Board of Trustees, after careful study and deliberation, endorsed the plan of the American Medical Association. I know our Board of Trustees have been accused of being followers of the American Medical Association, and right here in one of the most authoritative articles I have yet seen in the *Journal of the American College of Dentists*, I find this statement in justification of the position for which I am arguing.

The problem of providing adequate health care is not a new one. Starting in Europe in the middle of the last century, guilds and mutual benefit associations attempted to solve the problem through cooperative agencies; from this beginning the movement to create adequate health care has spread over nearly the entire world.

Health insurance in various forms has been the method most commonly employed in efforts to provide adequate health care. Today over forty of the main nations have some form of health insurance in operation.

I would like to have you pay attention to this remark, and the writer is on a side opposite to that which I take, but I am glad to cinch my argument by his own statement: "The insurance systems vary greatly." Of course they do, because no one has worked out a successful one. "Some are quite effective for the countries in which they operate. . . ."

May I say that this would not apply to conditions such as we have here. It may be true in countries where they subjugate 65 per cent of the people to a level that is deplorable.

". . . while others are but footballs of political expediency and patronage or serve as opportunities for exploitation of the public and the profession, by commercialized groups. The more pernicious systems have created chaotic conditions in health service and have demoralized practitioners."

One finds another interesting statement in this article:

"The American Dental Association, which tends to follow closely the example of the American Medical Association, adopted a series of principles at its annual meeting in August, 1934. Although editorially the *Journal of the American Dental Association* has been reactionary on the subject of adequate health care, probably the dental profession in general is more progressive."

To return to our contacts in Europe: To show you other ways of approach which we used, may I say I have 100 per cent attendance at the Rotary Club for

six years, so while in the European countries, I kept up my attendance in Paris, Brussels, London, and Cork and on the boat.

In London, as I did in every place, I asked for the dentist of the club. I found he was a Mr. Brighton, a registered dentist, not a graduate. I enjoyed my visit with him immensely and derived a great amount of information during one luncheon hour. As we discussed this subject, he very frankly told of the troubles, the degenerative effect on practice, the lowering of standards of work, the pauperizing state of fees, etc.

All at once, the man at my left at luncheon said, "May I inject myself in here? I heard your conversation and I know you are discussing the health insurance program. I happen to be the chairman of the Electrical Works Friendly Society and I have charge of the expenditure of all our funds. I can give you a little different slant on some of these subjects from what the dentist may give you."

We had a very interesting discussion and I received information which would not have been brought out had I not had the two angles. As the presiding officer called the luncheon to order, I said, "I want one word here." I had not had a chance for a word from the time the two started their cross-fire.

I said, "You, as the dentist, have informed me that the health insurance program has lowered the standards of dentistry in your country until you are truly apologetic for it. You tell me it has taken food and a living wage away from the conscientious dentist. You tell me it has put this income into the hands of the incompetent and unscrupulous man who is willing to divide with the administrator.

"*You* as the representative of the Friendly Society tell me your group would be glad if they could throw out the insurance plan and be free to spend their own money as they desire." Both agreed to it.

In discussing the question of indigency and referring to the various European systems, by whatever name designated, in any particular country, I want it understood I am in no way referring to the man confining himself to private practice exclusively, or limiting himself to a small percentage of panel or insurance practice.

These men have been noble in purpose and have striven to combat the degenerative effects of insurance regulations and diminishing fees resulting from this unfair and unethical system. Theirs has been an uphill fight in the face of impossible odds, with handicaps that have been enough to dishearten less courageous men. They are worthy of our highest commendation and merit our everlasting gratitude for their determined fight against the influence of these vicious systems.

I beg you, in considering my discussion of this subject as it applies to the insurance practitioners, to understand that this system has betrayed men and broken down their standards, owing to the impossible and impractical requirements established by lay dictation, political greed and governmental interference with this particular professional service.

European compulsory health insurance in dentistry fails to protect humanity with any reasonable dental health service program for preventive dentistry. European compulsory and health insurance practices no reasonable restorative dentistry. There is a standard of fees for the little cavities and pit cavities, but most of the work along this line consists of extractions, and that is where they get the name of blood and vulcanite dentists, because they "yank" the teeth out and

put in the lowest grade of vulcanite plates.

European health and compulsory insurance practices no modern method of diagnosis to safeguard health and protect the happiness of the human family. It fails to utilize the roentgen-rays as an agency for the benefit of humanity, and there is no attempt at conservation of the extensively decayed teeth and no attempt, in a large percentage of this practice, at prophylaxis as we in America practice it for the benefit of our patients.

The utilization of partial denture appliances with clasp attachments is virtually if not indeed an unknown procedure in those countries where compulsory insurance is prevalent, and no genuine effort is made to maintain or restore the physical features of the victims who are forced into utilization of artificial restorative machinery.

Dr. Casto and I attended the Welch Music Festival when Lloyd George spoke. I believe I can say with all truthfulness that 80 per cent of the men and women over 25 years of age who passed us wore the most disfiguring and hideous types of artificial restorative devices which were ever utilized and imposed on the human race. The insurance systems provide no funds for medical-dental care until the people pay it or have it subtracted from their pay check in their monthly allotment over a given period. Outside of a real emergency relief extraction, it is about the only dental care that they get. They are not eligible to have it until they have paid into the fund for five years.

Under this system, there is no provision for adequate dental service to preserve the normal masticating organs in the state of health which American citizens are accustomed to expect and which we have heard so much about in discussion on this subject.

It does not allow the dentist to exercise individual discretion and judgment in deciding the work that is to be done or the time when it should be done. It has to be done under the order and approval of these lay administrators and if the dentist, with the meager fee he works for, happens to do more than the authorities feel should be done, it is disapproved.

Of course, it is stated that the people can select their own dentist. According to the law, they can, but according to the operating system, they cannot. If the patient wants certain work done and goes to the dentist whom he wishes to patronize and a requisition is made out telling what is to be done and what it will cost, it is taken to the lay supervisor and administrator, who says it is too much—it cannot be done. The patient has suffered long enough and goes back and asks where he can get a dentist who will do it for less. The patient goes to the one whom he recommends and with whom he is in collusion.

All this leads to the lowering of dental standards in all classes of service, because those people who buy their own dental service and pay for it are contaminated by the influence of this vicious system. They are not willing to pay a reasonable fee for the service when they know that compulsory insurance has established a different standard of fees.

I have never had a duty to perform which has caused me more worry than this that I have to perform tonight. I face a responsibility the equal of which I have never faced before. If I fail to convey its importance to you as leaders of the profession, you will fail to convey to the dentists of this country the seriousness of this situation as it is exemplified in European practice.

If we condemn what others have been offering as the solution for our social ills, we must offer something practical

and something which will afford ways and means to provide a system that will supply dental service and for a larger percentage of the human family. On that, we are all agreed.

Our program which will be presented tonight offers such a plan. It must be one that provides for the maintenance of individual responsibility. It must provide for the development of personal self-esteem. Character and will power are only developed by rugged individual efforts. Our dental program must perpetuate America's superior service. It must safeguard the personal relationship, the sacred relationship of patient and dentist, without the interference of any imposed lay dictator or political henchman.

What are we going to do about it? The patient must be allowed to maintain his pride and must retain his self-esteem. Patients must be encouraged by a sound, sympathetic economic set-up, one that provides financial underwriting, be it for a big or a small job, one that will make salesmanship of dental health service competitive with the practices that sell the luxuries and the super-luxuries, non-essentials which are sold into every American home.

Our American citizenry like the partial payment system and look for demonstrations of salesmanship. They are accustomed to having many of the things they need delivered to them on a projected payment plan. Therefore, for those people of the lower bracket income class, we must provide a system, without embarrassing red tape, that will make it possible for the multitude to secure dentistry on a plan that maintains and stimulates their own responsibility and their own pride and esteem in themselves.

I was impressed with a cartoon which appeared in one of the local papers the night before last. The caption reads "Thank you for the health and beauty in America's smile." In no place where we traveled abroad did a majority of the human family carry a countenance that could smile naturally and portray happiness because they were so busy holding on to artificial dentures, which they feared would fall out of their mouths if they did not pull their lips down.

I hope that I have not been unkind in my endeavor to picture these conditions which I have observed. The responsibility of trying to bring this message to American dentistry burns into me. American dentistry has a responsibility because the people of our country do not know the menace that is hanging over them in this controversial question.

It is our duty to join with the American medical profession and those sound influences in our country that see the menace of this whole program and are willing to aid us in protecting humanity from the destroying influence of this vicious system.

I am reminded of one other happening during our trip. Dr. Casto and I had to travel fast and had to jump from point to point without waste of time. We traveled from Brussels to London by plane. When we came toward the channel, we entered a storm cloud and we traveled in the darkness of the cloud. Since I had my clothes and shoes on, I did not like the prospect of landing in the channel; but we went on, and the pilot, being level-headed, showed conservative skill and judgment, and carried us on up above the clouds. When we came out above the dark cloud, there was no chance to see the English channel or the country down below, but it was a beautiful sight, the equal of which I have never experienced, and I have experienced a number of storms in the air. The fog cloud with the sun shining on it was as white as the snow-covered mountains

of my country after a big storm. There were peaks that projected here; there were chasms that dipped down into the clouds like the great giant crevasses of the glaciers of Alaska. We were spellbound by the majestic beauty and grandeur of this scene. We compared these white peaks to the mountain scenery of the Rockies.

Then we looked deep into these chasms, these impenetrable depths where man could not even imagine what was beyond. One of them seemed bigger and more majestic than the others; a little hole opened down through the cloud and we saw a French village, green and beautiful. In the twinkling of an eye, it was gone, and we beheld only the top of the clouds again, and everything that gave promise of security to us was taken from our vision. But we had trusty pilots steering us. While they could not see where they were taking us, nor could they tell us just how they were going to get us there, we flew on and on until we left the storm behind. We beheld the earth below with all its wonderful inspiring sights and traveled on to London in safety.

Like that cloud with its depressions and its peaks, civilization travels on and on, and it matters not if we come to one of these distressing periods where mere man cannot see the answer to it all. A greater power, a supreme intelligence, a guiding hand will steer humanity safely into the airport and set this plane of ours down, whether or not you or I am here to know it, and the human family will go on protected, safe.

Resolution Passed by the House of Delegates Regarding Dental Service Plans, November, 1935

Whereas, for the past few years there has been considerable agitation concerning changes in medical and dental practices; and

Whereas, out of this discussion has come no concrete expression of opinion as to how best to furnish health service to all the people that would be at once fair and equitable to all parties concerned; and

Whereas, the Board of Trustees of the American Dental Association have gone on record as opposing the socializing of the dental profession and all plans of compulsory health insurance; and

Whereas, the Committee on Economics of the American Dental Association believes the most effective opposition to such forms of practice would be a system under full control of the organized health professions, which will supply health service to all of the people; and

Whereas, it has been the custom of our people, when seeking health service to pay for what they get and get what they pay for, we recognize the fact that health service must be provided for the indigent and those whose income is insufficient to pay customary fees for dental care; and

Whereas, to meet these conditions health services for the low income groups should be supplied at fees which are within the limits of their ability to pay, and the care of the indigent must be, as it always has been, a charity problem of each community, therefore be it

Resolved, that the American Dental Association in annual session assembled approve of further study and experimentation with plans to furnish such services as have been established in Washington, D. C., and St. Louis, Mo., as we believe that the outcome of such practical research might terminate in a satisfactory solution of the vexing problems of providing adequate dental service to the low income group.

"DENTAL PROSPECTS"

The November issue of the Journal of the A.D.A., pages 1989-90, contained statistics under the title, "Dental Prospects." Credit for these statistics was erroneously given to the American Dental Trades Association.

Since the publication of this article, it has been learned that the statistics quoted were not issued by the American Dental Trades Association, but were taken from information furnished by the Bureau of Vital Statistics, Washington, D. C.

CURRENT LITERATURE

Clinical Significance of Experimental Studies in Wound Healing (E. L. Howes and S. C. Harvey, Ann. Surg., 102:941 [Nov.] 1935): The authors made observations on healing wounds in experimental animals and, from certain of their studies, they felt justified in making various generalizations: Healing is a variant of growth taking place chiefly in two phases, fibroplasia (originating in relatively undifferentiated cells closely related to the mesoblast) and differentiation (of the products of the first phase). Only profound systemic changes disturb wound healing, but locally healing may be delayed by excessive exudative reaction. These generalizations appear to hold true for the common laboratory animals and for man.

HAMILTON ROBINSON.

Anthrax: Clinical Report of Ten Human Cases (H. Gold, J. Lab. & Clin. Med., 21: 134 [Nov.] 1935): The ten reported cases of anthrax were all traced to infected goat hair received in an Eastern mill. Seven cases occurred in mill employes, two in children playing behind the mill and one in an employe of a plant to which some of the infected material had been shipped. Five of the patients showed the lesion on the face and one of these resulted fatally, all the others surviving. Anthrax serum (human) was used intravenously, not locally, in the nine cases successfully treated.

HAMILTON ROBINSON.

Glossodynia: Reflex Irritation from Mandibular Joint as Principal Etiologic Factor (J. B. Costen, Arch. Otolaryngol., 22:554, 1935): The author found in a study of ninety patients with symptoms of neuralgia associated with the temporomandibular joint, ten patients with burning pain in the tongue and pharynx. Repositioning of the mandible gave complete relief to these patients. In the detailed report on the ten cases in which glossodynia resulted, it is interesting to note that all had some type of malocclusion, with consequent temporomandibular changes. In a number of these cases the jaws were repositioned by construction of properly articulated dentures. Associated with glossodynia, other symptoms were intermittent impairment of the hearing, dizziness, a feeling of stoppage of the auditory meatus, headache and a burning in the nose and throat. Later, herpes in the external auditory canal and on the buccal mucosa was noted in some of the cases. The author believes the burning is produced reflexly owing to pressure of the condyle on the auriculotemporal nerve and transmission to the lingual nerve. Some of the patients spoke of a metallic taste and a stinging sensation on the tongue. Close connection of the chorda tympani nerve to the tongue might account for these symptoms. By proper placing of the dentures, or a disk, the vertical distance between the jaws was increased, with the result that the head of the condyle was moved down and forward. This released the pressure on the nerves passing in the region of the joint and relieved the patient.

M. W. MCCREA.

Painful Lingual Papillae (M. Scholtz, Arch. Derm. & Syph., 32:801 [Nov.] 1935): Attention is called to a disorder of the lingual mucous membrane, seen mostly in middle aged patients wearing dentures

and complaining of painful spots on the lateral aspects of the tongue near its base. Seemingly enlarged vallate papillae can be seen without inflammatory reaction. Repeated electrodesiccation gives relief. The condition may be the result of irritation by the dentures or a psychogenic factor of cancerophobia.

HAMILTON ROBINSON.

Treatment of Malignant Tumors of Upper Jaw and Antrum: Fifteen Years of Progress (Gordon B. New, Surg. Gynec. & Obst., 61:706, 1935): The author reviews a monograph by L. George Ohngren, "Malignant Tumors of the Maxilla-Ethmoid Region," in which was reported the work of Gunner Holmgren's service at the Sabbatsberg Clinic, Stockholm. Ohngren had traced the development of the treatment of these tumors. At first, resection of the jaw was carried out by the general surgeon, with poor results. Next, men specially trained in this field employed pure surgical treatment, the results still being poor. Then roentgen rays and radium were used in conjunction with the surgical treatment, but the results were not much better. Finally, in 1922, electrosurgery was used, and, in 1927, radium in conjunction with the electrosurgery, and the results were good as compared with the former results. Ohngren originally classified tumors of the upper jaw on the basis of (1) the more or less favorable position of the tumor; (2) the greater or lesser degree of histologic malignancy and (3) the presence or absence of metastasis. Ohngren reports on the basis of the foregoing classification his percentage results in 149 cases in which operation was performed. It is by such work as this that advances are made in the efforts to control malignant diseases.

J. FRANK HALL.

Multiple Bone Tumors with Unusual Diagnostic and Therapeutic Characteristics (E. L. Jenkinson, Am. J. Roentgenol., 34:457 [Oct.] 1935): Pathologists recognize the difficulty in diagnosis of lesions of bone, not only by roentgenograms but also by microscopic examination of the tissues. The report is of a case of multiple bone lesions extending over a period of three and one half years. A man, aged 50, fell and sustained an injury of the right hip in July, 1931. Three months later, the right leg gave way while the patient was walking across the floor. Diagnosis revealed a fracture of the femur as well as a large circumscribed area, cystic in appearance. Ten treatments by the roentgen rays were administered over a period of a month. Two months later, examination showed texture of the bone improved, but no regeneration.

One year later, in January, 1933, the patient again came in, with a large mass involving the lower right jaw, the size of a man's hand. Roentgenograms revealed a large homogeneous rarefied area about the angle. The cortex along the inferior border was intact except for a pathologic fracture. The cortex in one area along the alveolar border was absent, the region resembling a malignant tumor. Roentgenograms revealed no evidence of a bony union at the site of fracture of the right femur. Roentgen therapy was advised, to be applied to the femur and also to the jaw. Two weeks after the first treatment, the jaw became smaller and the pain subsided. In five months, the jaw appeared normal. Eight months later, in January, 1934, the patient came in again, with the left arm twice its normal size. Roentgenograms revealed a large destructive area extending through the cortex and periosteum and into the surrounding tissues. The lesions differed from those present in the jaw and femur. A biopsy specimen from the humerus was diagnosed as myeloma without plasma cells. Roentgen therapy was administered, 320 r over the anterior surface of the humerus on one day and 280 r over the posterior surface the next day. Seven days after the initial treatment, the tumor of the humerus was reduced to one half the original size. Additional roentgen therapy was applied to the humerus, alternating between the anterior surface and the posterior surface until the anterior surface had 1,018 r and the posterior surface 864 r. The rib had a total of 738 r. Roentgen therapy was also applied to the right seventh rib, which showed a degenerating

area. On reviewing the series of roentgen ray treatments, one is impressed with the small amount of irradiation necessary to bring about prompt improvement in some lesions, while large doses of roentgen rays were required for other lesions in the same case. Some of the bone areas became quite rarefied, while others did not. Some of the fractures showed an osseous union early, while others were slow in uniting. The diagnosis of the bone lesions of this patient must of necessity change with the appearance of the multiple lesions.

J. FRANK HALL.

Treatment of Depressed Fractures of Zygomatic Bone and Zygomatic Arch (Robert F. Patterson, J. Bone & Joint Surg., 17:1069 [Oct.] 1935): Fractures of the zygomatic arch are often depressed and difficult to reduce without scar formation. Cases in fleshy persons are especially difficult. If they are treated by open operation, an unsightly scar results, which is a source of mortification to the patient. Great force is often necessary to pull the bone outward and into place. It is often necessary, after using instruments ordinarily suggested, to resort to the use of the powerful veterinarian tenaculum. This instrument is introduced below and beneath the malar bone, the skull being used as a fulcrum. The ordinary ice pick is often useful in reduction of fractures of the zygomatic arch.

F. FRANK HALL.

Susceptibility to Dental Caries in Rat: V Influence of Calcium, Phosphorus, Vitamin D and Corn Oil (Theodore Rosebury and Maxwell Karshan, Arch. Path., 20:697 [Nov.] 1935): The authors attempted to isolate the food agents responsible for production of experimental caries as observed in previous experiments with diets adequate in calcifying properties. The basic, deficient diet of rice, dextrin and spinach was modified in various ways including grinding the rice more finely, adding calcium, phosphorus, cod liver oil, wheat gluten and viosterol in corn oil and by supplementing with ultraviolet irradiation. Statistical studies of the results on 286 animals on the various diets indicated that, with coarse rice, dental caries is produced irrespective of the calcium content and, with finely ground rice, the incidence of caries becomes zero with both high and low calcium diets; addition of cod liver oil or viosterol in corn oil reduces dental caries, but does not prevent it; irradiation with ultraviolet rays in sufficient dosage to improve calcification as much as 5 per cent cod liver oil is less effective than feeding vitamin D (this result statistically inconclusive); addition reduces dental caries, indicating that at least part of the protective effect of vitamin D in oil preparations is contributed by the vitamin free oil, and the calcium-phosphorus blood level seems unrelated to dental caries. "From the evidence as a whole, it appears that the protective effect against caries exerted by calcifying foods may be independent of the mechanism of calcification and possibly of metabolic influence generally."

HAMILTON ROBINSON.

Reliable Method for Testing Sterility of Surgical Catgut Sutures (R. O. Clock, Surg. Gynec. & Obst., 61:789 [Dec.] 1935): After making extensive bacteriologic tests over a period of years on catgut sutures, experienced bacteriologists such as Bullock, of England, Knorr, of Germany, and Leleney and Chatfield, of the United States, found that an average of about 75 per cent of the products of suture manufacturers contained living aerobic and anaerobic bacteria. The author determined to make an efficient and reliable test, working five consecutive years (1930-1934), during which time 12,522 surgical sutures, comprising twenty-four foreign brands and twelve American brands, as well as several thousand experimental sutures, were tested. During this time, he has determined the nonsterility of 62.5 per cent of twenty-four foreign brands and 50 per cent of twelve American brands. A reliable bacteriologic test is described in detail, including the materials used, the actual steps of the technic and a complete set of controls. This reliable test may be adopted by any authoritative body which is interested in con-

trolling the sterility of catgut sutures used in this country. The Food and Drug Administration of the United States Department of Agriculture has an adequately equipped bacteriologic laboratory, a staff of efficient technicians and a corps of collectors, who were able to obtain the necessary sutures of the various brands from the open market throughout the country. In this department, the testing of the sutures could be carried out in an impartial manner.

J. FRANK HALL.

Congenital Median Cleft of Chin (W. J. Steward, Arch. Surg., 31:813 [Nov.] 1935): A case of median cleft of the chin, an extremely rare condition, is reported in a female infant. The lip was held together by adhesive plaster up until the sixth week. At this age, the edges of the cleft were freshened and approximated with sutures. An attempt to unite the mandible with heavy chrome suture dislodged two tooth buds and, for this reason, together with the seemingly poor condition of the child at operation, this stage of the operation was postponed. At 10 months, the lip was revised, with cosmetic improvement. No attempt will be made to unite the mandible until the permanent teeth have erupted. HAMILTON ROBINSON.

Therapy of Jaw Fractures and Face Injuries (outlined by J. E. Schaeffer and M. B. Skinner, edited by M. Fantus, J.A.M.A., 105:1679 [Nov. 23] 1935): Patients with a history of trauma with pain or swelling about the face should be carefully examined for possible fractures. Immediate reduction is indicated unless injury is so severe as to endanger the patient's life. After fixation, the patient should be instructed to cleanse the mouth carefully after each feeding by use of a small toothbrush and a dentifrice. Infection should be guarded against and treated if it develops. For fracture of the arch, some form of intermaxillary wiring is recommended. In complete transverse fracture of the maxilla, fixation outside the mouth is required, and this is accomplished by use of intermaxillary wiring attached to a plaster skull cap or by a Kingsley splint. Fractures of edentulous arches may be treated by rest and soft diet alone or may require direct or circumferential wiring. Fractures back of the last molar may be treated by arch wires with an extension back of the line of fracture which is forked to fit over the bone fragment and bent to hold it in position when the teeth are occluded and wired. Wiring the teeth into position usually is satisfactory for fractures of the neck of the condyle. For extensive maxillary fractures, it is necessary to elevate the depressed bone fragments into position and to suture the injured soft tissues. Lacerations are treated by thoroughly cleansing with green soap and water, irrigating with sterile water and swabbing the surrounding tissue with alcohol. The mucous membrane is then sutured from within the mouth with black silk suture, deep tissues with 0000 catgut and skin surfaces with horsehair. All of these procedures are given in detail.

HAMILTON ROBINSON.

Fossils in New Mexico: The fossilized skull of a shark which inhabited the fresh water streams of New Mexico in the Paleozoic geologic era of about 225,000,000 years ago, has been found in New Mexico by a party of University of California scientists. Thirteen skulls of amphibians of the same era, and numerous fragments of as yet unclassified reptiles, were also uncovered. The skull of the shark was about six inches wide and a foot long. This animal was probably four feet in length. It had teeth not more than a quarter inch in length, and large gill arches. The largest of the amphibian skulls was ten inches in length and eight inches wide. The body of this animal was about four feet long. Its entire bodily structure was thin and delicate. A peculiar feature was the existence of four spines, which projected back over its neck. In appearance it resembled somewhat the giant salamander found in Japan today. These remains were found embedded in the side of a hill near the head of a dry stream bed, the Arroyo de Agua, which is about sixty miles northeast of the City of Santa Fe.—*Science,* Oct. 25, 1935.

Orthodontia: In the case of a boy, aged 16 years, with a receding lower jaw and malocclusion, and some teeth with bad alinement, is he still young enough to expect any help from orthodontic treatments? Will braces be likely to cause a loosening

of the teeth and eventually necessitate extraction? *Answer:* The condition described can be treated, and normal relation of the teeth established at 16 or even later, although the correction can be made more easily before the eruption of the second permanent molars, the so-called twelve-year molars. The earlier the correction is made, the longer the time during which the jaws and the face can develop under normal conditions, and the better will be the esthetic result. Great improvement can be made, however, even after maturity has been reached. The teeth will undoubtedly be retained longer if normal occlusion is established than they will if the condition is not corrected. There is no danger of loosening or losing the teeth if orthodontic treatment is properly conducted, although treatment by the inadequately prepared may bring about these undesirable results. The treatment of such cases requires special knowledge and training not expected of the general practitioner of dentistry.—*J.A.M.A.*, Sept. 14, 1935.

FOREIGN LITERATURE

Chemical Analysis of Human Bone (M. Coppo, Fisiol. e Med., 5:237, 1934): The average values for constituents of bone were found to be water, 14.064 per cent (compact bone); 34.738 per cent (spongy bone); dry weight, 85.936 per cent (compact bone); 65.262 per cent (spongy bone); ash, 65.030 per cent of dry, defatted, compact or spongy bone; organic, 34.936 per cent of dry, defatted, compact or spongy bone; organic, 34.936 per cent of dry, defatted, compact or spongy bone; calcium, 26.129 per cent of dry, defatted bone; phosphorus, 9.717 per cent of dry, defatted bone; magnesium, 0.332 per cent of dry, defatted bone; potassium, 0.132 per cent of dry, defatted bone; nitrogen, 0.610 per cent of dry, defatted bone; chlorine, trace. Human bone is similar chemically to bones of other mammals. There is a normal variation between various bones in the same person, but that variation is less than the difference between the same bone from different persons. The calcium-phosphorus ratio is very constant for all bones, of a value 2.6-2.7, which is near that of blood.

HAROLD C. HODGE.

NEWS

New Society Formed: At the Lincoln State School and Colony, Lincoln, Ill., a meeting was called by Mrs. Dorothy L. Kay, assistant director of the Department of Public Welfare, and a society was formed called the Illinois State Institutions' Dental Association. The following officers were elected: President, H. A. Landess, Lincoln; vice president, M. Summers, Jacksonville; secretary, G. W. Farrell, Dixon. The purpose of the society is to promote a better understanding of institution problems between the dentist and the public.

Death of Dr. Mix: Charles L. Mix, M.D., Chicago, Ill., formerly head of the faculty of Loyola University School of Medicine, died November 22, at the age of 66. Dr. Mix was a graduate of Harvard University Medical School in the class of 1894. He taught anatomy in Northwestern University Dental School for several years.

Drs. Rowe and Wiberg Victims of Assassin: Arthur T. Rowe, associate dean of the Columbia University College of Dentistry, and Paul B. Wiberg, associate professor in the same school, were shot and killed December 12 by a discharged laboratory handyman, who then wounded William H. Crawford, also a teacher in the dental school, and ended his own life with a bullet. The murderer, who had been befriended by Dr. Rowe over a long period in which frequent discipline and dismissal had been necessary, was believed to have suffered from a persecution complex and was constantly in difficulty because of fighting with other employes. The three victims of his mania were all graduates of the University of Minnesota. Dr. Rowe,

who had practiced in Minneapolis and the Dakotas, is survived by his widow and two children.

DEATHS

Barrick, H. S., Newark, Ohio; Ohio State University, College of Dentistry, 1899; died September 20; aged 59.

Bowman, Glenn F., Pittsburgh, Pa.; University of Pennsylvania School of Dentistry, 1897; died September 21; aged 60. Dr. Bowman entered general practice in Tidicute, Pa., on his graduation. In 1907, he went to St. Louis to study orthodontia under Angle, beginning the practice of his specialty in 1909 in Pittsburgh. He was a member of the Academy of Dentistry, Odontological Society of Western Pennsylvania and Edward H. Angle Society of Orthodontists. The widow and two daughters survive.

Cummins, John T., Metropolis, Ill.; Chicago College of Dental Surgery, 1877; died November 4; aged 82.

De Lashmutt, Clarence S., Bucyrus, Ohio; Ohio State University, College of Dentistry, 1919; died September 4; aged 42.

Hall, Wilbur S., Pensacola, Fla.; George Washington University Dental Department, 1896; died September 27; aged 63. Dr. Hall was a member of the Florida Dental Examining Board from 1910 to 1927. He was president of the board for five years.

Keefer, John B., Portland, Ore.; Department of Dentistry Vanderbilt University, 1888; died November 2.

Ketcham, Albert H., Denver, Colo., Tufts College Dental School, 1892; died December 6, of bronchial pneumonia. Dr. Ketcham was an orthodontist and a member of Delta Sigma Delta Fraternity.

MacNeil, Hugh, Chicago, Ill.; Chicago College of Dental Surgery, 1891; died December 10; aged 76.

Manne, William M., New York City; New York University College of Dentistry, 1912; died recently.

McKelvey, William A., Atchison, Kan.; Temple University School of Dentistry, 1880; died September 10; aged 77.

Rauh, Sidney J., Cincinnati, Ohio; Temple University School of Dentistry, 1896; died November 19.

Rich, George Wilbur, Dayton, Ohio; Ohio State University College of Dentistry, 1903; died September 19; aged 65.

Skiff, Seymour S., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, 1906; died November 4; aged 50.

Starbuck, A. W., Denver, Colo.; University of Iowa College of Dentistry, 1898; died December 7; aged 58. Dr. Starbuck was at one time superintendent of the Dental College of Denver University and was a past president of the Denver Dental Association. The widow survives.

Stephenson, William Allman, Galena, Ill.; Northwestern University Dental School, 1898; died October 23; aged 59.

West, J. Edward, Geneseo, Ill.; Northwestern University Dental School, 1896; died November 1; aged 63.

MISCELLANY

BOOK REVIEWS

Infant Nutrition—A Textbook of Infant Feeding for Students and Practitioners of Medicine. By William McKim Marriott, B.S., M.D., Professor of Pediatrics, Washington University School of Medicine; Physician in Chief, St. Louis Children's Hospital, St. Louis. Second Edition. Illustrated. 431 pages. Price, $4.50. Published by the C. V. Mosby Company, St. Louis.

In recent years, much attention has been given the general subject of nutrition in dental textbooks and periodicals, and there has been considerable diversity of opinion. On the whole, there has been definite progress and substantial gain as far as the fundamentals of nutrition are concerned. In

no department of the study has this gain been more apparent than in the feeding of infants. This must at once be apparent in the improved condition of the babies of the land. It is a rare exception now in anything like intelligent society to see an ill fed baby. Dr. Marriott has done his full share in bringing about this betterment in babies. His first volume issued five years ago sounded a sensible note on many important phases of the subject, and there is no question that many of his recommendations have borne fruit. For the second edition, the author has shown a laudable tendency to condense his work and to eliminate certain material that had already been sufficiently emphasized or had been proved not entirely significant. In view of the fact that, with the present complicated machinery of life, the modern mother does not always find it expedient or possible to nurse her own baby, the question of artificial feeding becomes an important one, and in this volume a chapter on "Artificial Feeding" is given. One of the most prevalent and disastrous results of improper feeding in infants is the condition known as rickets. This is a common nightmare of malnutrition among children, and it is something that can readily be obviated by recourse to the fundamentals of common sense feeding. With all of the information that has been accumulated on this subject, there is no longer any excuse for children to be subjected to the penalty of deformity through inadequate diet. Dr. Marriott's book should be in the hands of every physician, every dentist and particularly every pediatrician. It is needed wherever children are being reared.

Immunology. By Noble Pierce Sherwood, Ph.D., M.D. Professor of Bacteriology, University of Kansas, and Pathologist to the Lawrence Memorial Hospital, Lawrence, Kan. 608 pages. Price, $6. Published by the C. V. Mosby Company, St. Louis.

This is an exhaustive study of the subject of immunology from apparently every conceivable angle. The book may well be classed as a necessity in the library of every practicing physician. It would be difficult to name a disease that has not been brought under consideration as far as immunity is concerned—with one exception. This exception is one that vitally concerns the dental profession, and it is hereby suggested that in future editions the author of this excellent work recognize the rôle that is played by immunology in the treatment of one of the most prevalent of all human diseases, dental caries. It has long been recognized that the most widespread of all diseases is decay of the teeth. This is so much a matter of common knowledge that it is current conviction everywhere, but it is not so generally understood that the factor of susceptibility and immunity in the manifestations of this disease is one of the most important considerations for the dental practitioner to recognize. It is recognized that no dentist can ever combat dental caries to the best advantage without a careful clinical study of immunity as it affects the prevalence of this disease, and failure to recognize this fact is accountable for most of the limitation that is encountered in efforts to check this disease. It therefore seems a pity that the author with his comprehensive grasp of the significance of immunology should not have brought to bear on this question the benefit of his genius and insight. A study of Dr. Sherwood's book will bring a rich reward in added knowledge of the important subject of immunology. Every practitioner of medicine or dentistry needs to have a relatively comprehensive grasp of the significance of this subject for the reason that in many of the manifestations of disease the question of immunity plays so important a part. A careful survey of this book with its many references will constitute a rather liberal education on the subject and the book as a whole is commended most highly.

The Parathyroids in Health and in Disease. By David H. Shelling, B.Sc., M.D., Johns Hopkins University and Hospital, Baltimore. Illustrated. 335 pages. Price, $5. Published by the C. V. Mosby Company, St. Louis.

While the thyroid gland has had the benefit of extensive investigation for many years,

recognition of the significance of the parathyroids is of more recent date. Now these small glands are being subjected to more intelligent scrutiny and their study is bearing fruit in an ever increasing extension of knowledge on the subject. The present book is one of the most comprehensive and satisfactory studies that has ever been given the subject. In fact, as far as the reviewer is concerned, it is the only really authoritative treatise from the point of view alike of the physiologic, or functional, and the pathologic manifestations of this important structure. And it is well that this study is made at this time. The significance of the calcium and phosphorus metabolism as affected by these glands will be better understood from a study of the present work. First, the anatomy of these small structures is considered as a basis of study. Failure to make an intelligent survey of the minute anatomic structures of these glands, particularly in their relation to the other immediate structures, led to much misconception by the early investigators. Sometimes, studies of structures as intricate as these present difficulties of an unusual character, and the present volume is all the more valuable in view of its authentic anatomic background. The "Pathology of the Parathyroids" comes in for much consideration, and this is discussed in great detail. The references in this chapter run to eighty-nine, which proves the extensive study given this phase of the subject. In view of the increasing interest in the clinical aspects of metabolism as affected by the parathyroids, the chapter on "Physiology" will call for much study, and the contributory literature on this one phase is represented by no fewer than 157 references. Such subjects as "Hyperthyroidism" and the relation of parathyroids to other glands and to the vitamins are adequately considered; and at the end of the book there is a comprehensive appendix containing every conceivable kind of diet as it relates to the various phases of the subject under discussion. The book is a mine of information on a most important topic and the literature of the profession is greatly enriched thereby.

Practical Dental Anatomy and Tooth Carving. A treatise on the essentials of dental anatomy as it pertains to the tooth crown and the principles and technic for carving and reproducing the tooth form. By Jacob R. Schwartz, D.D.S., Brooklyn, N. Y. With 305 original illustrations by the author which have been delineated in a manner to facilitate the studies for the undergraduate as well as the graduate student. 233 pages. Price, $3.50. Published by Dental Items of Interest Publishing Co., Inc., Brooklyn, N. Y. Henry Kimpton's Medical Publishing House, Great Britain.

No one can examine this volume without being impressed with the unusual artistic ability of the author. The drawings and photographs are representative of the best there is in illustrative work, and particularly the work that lends value and vividness to the textual description of any technical procedure. Dr. Schwartz is particularly fortunate in that he has the distinct advantage accruing from an ability to draw well. As this is a textbook on the making of models, the author outlines his method by showing first a plain block, and then the various steps necessary to bring form and harmony of design into the finished product. One can readily imagine that the man or woman who engages in this work must derive unlimited pleasure out of it. Not only this, but there can be no question of the practical utility of the work. The book will be a delight to readers and writers alike, and it should be in the hands of every dental student and practitioner. The publishers have cooperated with the author in a most acceptable manner, and the result is in every way satisfactory.

Meyer's Normal Histology and Histogenesis of the Human Teeth and Associated Parts. Translated and edited by Herman R. Churchill, Tandarts (Utrecht), D.D.S. (Georgetown University), Dr. Med. Dent. (Rostock), Assistant Professor of Dental Histology, Histopathology and Comparative Odontology, the Thomas W. Evans Museum and Dental Institute School of Dentisitry, University of Pennsylvania; Oral Pathologist at the American Oncologic Hospital of Philadelphia. 324 il-

lustrations, of which twenty-six are in color. 305 pages. Price, $4.50. Published by J. B. Lippincott Company, Philadelphia.

This is a most comprehensive presentation of the subject, illustrated in a lavish way, and produced on paper that readily lends itself to the best reproduction of picture and text. It is a pleasure to examine such a book. The different tissues are portrayed with accuracy, and the colored plates are especially satisfactory in this respect. Where every structure is represented with fidelity, it is difficult to particularize, but special mention might be made of the hard tissues of the tooth, the "attachment apparatus" and the development of the teeth. The adherence to nomenclature with such terms as "canine" and "pre-molar" is hardly in keeping with the most recent usage, or with the reports of the Committee on Nomenclature of the American Dental Association. These terms have been subjected to careful analysis, and have been discarded by the best writers. Even with this limitation, the book as a whole is a most worthy representative of the best dental literature and is deserving of great commendation.

New Pathways for Children with Cerebral Palsy. By Gladys Gage Rogers, Director of Robin Hood's Barn: a camp school for children with cerebral palsy; and Leah C. Thomas, Director of Therapeutics at Robin Hood's Barn; formerly Associate Professor of Hygiene and Physical Education, Smith College; formerly Director of Corrective Exercises under the direction of Dr. Joel E. Golthwait and Dr. Robert B. Osgood, Boston, Mass. 167 pages, with photographs by Newell Green. Price, $2.50. Published by the Macmillan Company, New York City.

Here is a book that, on behalf of many an underprivileged child, should command instant and sympathetic attention. The introduction is by Robert B. Osgood, and in it he says: "It is common knowledge that some of the world's finest minds are housed in athetotic bodies, whose every expression and movement belie the fact." And also: "We may again take heart and gird our loins, determined to give surcease of trouble to these children, and to make it possible for them to share with us the finer things of life." The authors of this book are entitled to the gratitude of every physician, every parent and every teacher of a child with a mental or physical handicap. Their approach to the problem is different from that of most of the writers on the subject. While great improvement in method has been made in recent years, the fact remains that there is yet a long way to go before the best results are achieved. The first chapter of the book, "Robin Hood's Barn," should constitute itself a textbook to be studied by every person connected with the care of these children. The insight of the authors into the psychologic phases of the problem is almost uncanny, and they have made a contribution to the subject that is incalculable in its benefit. An indication of the nature of the book may be had by glancing at some of the headings: "Body Mechanics," "Toys," "Relaxation," "Apparatus," etc. Probably the most graphic chapter in the book is the one entitled "A Case History." Any one who can read that chapter without moisture in the eyes is an insensate dullard and stoic. Though the moisture may first be induced by pity, it is brightened and sanctified by the ultimate joy of triumph. Read this book and learn what intelligence and devotion to duty may accomplish under adverse conditions.

CORRESPONDENCE

"Use of Drainage Crowns and Fillings in Restoring Bone in Alveolar Abscess Tracts"

To the Editor: The procedure outlined by J. J. Moffitt in "Use of Drainage Crowns and Fillings in Restoring Bone in Alveolar Abscess Tracts," published in the November, 1935, Journal, so flagrantly violates the principles of asepsis and the accepted rules for the treatment of pulp involved teeth that a vigorous protest is called for. The use of the gingival opening at right angles with the long axis of the tooth takes us back to the "horse and buggy days" and

the "cotton exchange period" of dental practice. Happily, we have progressed far since the days of prolonged treatment and the open or so-called drainage method, which was employed not because of the expectancy of satisfactory results, but because we were unfamiliar with the more advanced methods. Surgical drainage that by means of dressings and bandages protects the area under treatment against outside influence is not comparable to tooth drainage as advocated by Dr. Moffitt, which not only fails to provide such protection, but also actually maintains cesspools within teeth under treatment. Shall Dr. Moffitt be accused of naiveté when he refers to the use of germicides? (He mentions creosote.) Does he not know that germicidal values are dependent on the concentration of the germicidal agent and that when germicides are left in unsealed pulp canals, they very quickly reach a point of dilution that will render them inert? Also attention should be called to the dangers attending attempts to cleanse a canal by this means, but there are added possibilities of instrument breakage and perforation of the wall. It is good surgery and therefore good sense to proceed with the cleansing of a root canal by first gaining as nearly as practicable direct access to the root end area. Statements such as "the diagnostician was satisfied and the patient may live for many years"; "prevents internal pressure from the healing process"; "prevents possible infection from doubtful oral conditions," and "cement in the root canals had caused a slight puncture," are somewhat puzzling to say the least. Other statements in the article invite criticism, but it is not necessary at this time to go beyond a discussion of the fundamentals for successful pulp canal therapy. They are in order of procedure: diagnosis; access; thorough cleansing of canals; compact complete canal filling, and a surgically clean technic throughout the treatment and filling periods; and since we have at hand a means by which pulp involved teeth may be successfully treated and filled within from two to twelve days, there can be no excuse for subjecting patients to the annoyance, hazards and uncertainty of drainage methods. Finally, may I point out that the roentgenograms illustrating Dr. Moffitt's article vary so widely in angulation as to be of little or no value as evidence of results of treatment.

ALFRED WALKER,
501 Madison Ave.,
New York City.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, San Francisco, Calif., June 29-July3.

American Association of Dental Schools, Louisville, Ky., March 16-18.

American Board of Orthodontia, St. Louis, Mo., April 20.

American Society of Orthodontists, St. Louis, April 20-23.

Chicago Dental Society Midwinter Clinic, February 17-20.

Dental Protective Association of the United States, Chicago, Ill., December 16.

Five State Post Graduate Clinic (Maryland, Delaware, Virginia, West Virginia and North Carolina), Washington, D. C., March 8-11.

American Dental Society of Europe, August, 1937.

International Dental Congress, Vienna, August 2-9.

Philadelphia County Dental Society (in combination with Pennsylvania State Dental Society), Philadelphia, February 4-6.

Rocky Mountain Midwinter Clinic, Denver, Colo., January 13-15.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Southern Society of Orthodontists, Chattanooga, Tenn., January 27-29.

University of Buffalo School of Dentistry Alumni Association, February 12-14.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE SOCIETIES

February

Minnesota, at St. Paul (25-27)
Pennsylvania, at Philadelphia (4-6)

April

Alabama, at Birmingham (14-16)
Connecticut, at Stamford (15-17)
Kansas, at Salina (27-29)
Kentucky, at Louisville (6-8)
Louisiana, at Baton Rouge (26-28)
Massachusetts, at Boston (28-May 1)
Michigan, at Detroit (20-22)
Montana, at Butte (16-18)
New Jersey, at Atlantic City (22-24)
Wisconsin, at Milwaukee (21-23)

May

Georgia, at Atlanta (11-13)
Illinois, at Peoria (12-14)
Indiana, at Indianapolis (18-20)
Iowa, at Des Moines (5-7)
Maryland, at Baltimore (4-6)
New York, at New York City (12-15)
North Carolina, at Pinehurst (11-13)
Tennessee, at Memphis (4-6)
West Virginia, at Fairmont (18-20)

June

Maine, at Portland (26-27)
Missouri at St. Louis (8-10)

STATE BOARDS OF DENTAL EXAMINERS

Colorado, June 23-27. David J. Tepley, 807 Republic Bldg., Denver, Secretary.

Florida, at Jacksonville, June 22-26. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Mississippi, at Jackson, June 16. T. Ford Leggett, Laurel, Secretary.

GEORGIA DENTAL ASSOCIATION

The sixty-eighth annual meeting of the Georgia Dental Association will be held in Atlanta, May 11-13.

R. H. MURPHY, *Secretary,*
920 Georgia Casualty Bldg.,
Macon.

KENTUCKY STATE DENTAL ASSOCIATION

The sixty-seventh annual meeting of the Kentucky State Dental Association will be held at the Brown Hotel, Louisville, April 6-8.

J. H. FULLENWIDER, *Secretary,*
1101 Heyburn Bldg.,
Louisville.

MICHIGAN STATE DENTAL SOCIETY

The next annual meeting of the Michigan State Dental Society will be held at the Statler Hotel, Detroit, April 20-22.

WILLIAM R. DAVIS, *Secretary,*
Michigan Department of Health,
Lansing.

NORTH CAROLINA DENTAL SOCIETY

The sixty-second annual meeting of the North Carolina Dental Society will be held May 11-13 in the Carolina Hotel at Pinehurst.

FRANK O. ALFORD, *Secretary,*
Charlotte.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Florida State Board of Dental Examiners will be held in Jacksonville, June 22-26. Applications must be filed thirty days before examination.

H. B. PATTISHALL, *Secretary,*
351 St. James Bldg.,
Jacksonville.

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

The next examination of the Mississippi State Board of Dental Examiners will be held at Jackson in the Capitol Bldg., beginning June 16. All applications must be in the hands of the secretary at least ten days prior to the date of examination. For further particulars, address

T. FORD LEGGETT, *Secretary,*
Laurel.

TENNESSEE STATE DENTAL ASSOCIATION

The Tennessee State Dental Association will hold its sixty-ninth annual meeting, May 4-6, at the Hotel Peabody, Memphis.

E. J. JUSTIS, *Secretary,*
Exchange Bldg.,
Memphis.

CHICAGO DENTAL SOCIETY MIDWINTER CLINIC

The seventy-second annual midwinter clinic of the Chicago Dental Society will be held at the Stevens Hotel, February 17-20. The official program will be mailed to all members of the American Dental Association early in January. There will be four days of essays and clinics, with night sessions, and the scientific and commercial exhibits will be open throughout the meeting. The commercial exhibit will be the largest of its kind held since 1931, with the exception of that of the Chicago Centennial Dental Congress. Hotel reservations should be made early.

WILLIS J. BRAY, *Secretary,*
30 N. Michigan Ave.,
Chicago, Ill.

DENTAL HYGIENISTS ASSOCIATION OF PENNSYLVANIA

The annual meeting of the Dental Hygienists Association of Pennsylvania will be held in Philadelphia, February 4-6.

KATHLEEN A. HOLDEN, *Publicity Chairman,*
4622 Adams Ave.,
Philadelphia.

ROCKY MOUNTAIN MIDWINTER CLINIC

The Rocky Mountain Midwinter Clinic, given by the Denver Dental Association will be held in Denver, January 13-15, at the Brown Palace Hotel.

ALBERT P. HORTON, *Secretary,*
1550 Lincoln St.,
Denver, Colo.

AMERICAN ASSOCIATION OF DENTAL SCHOOLS

The next meeting of the American Association of Dental Schools will be held in Louisville, Ky., March 16-18.

A. R. MCDOWELL, *President,*
College of Physicians and
Surgeons School of Dentistry,
San Francisco, Calif.

AMERICAN SOCIETY OF ORTHODONTISTS

The American Society of Orthodontists will hold its next annual meeting, April 20-23, at St. Louis, Mo.

CLAUDE R. WOOD, *Secretary,*
Medical Arts Bldg.,
Knoxville, Tenn.

NORTH ST. LOUIS DENTISTS MEETING

The seventh annual midwinter meeting of the North St. Louis Dentists will be held January 29-30, at the Fairgrounds Hotel, St. Louis.

A. C. MOGLER,
4482 Washington Ave.,
St. Louis, Mo.

UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION

The thirty-sixth annual "Open House" of the University of Buffalo School of Dentistry Alumni Association will be held at the Hotel Statler, Buffalo, February 12-14.

J. JAY FULLER.

AMERICAN DENTAL SOCIETY OF EUROPE

The next meeting of the American Dental Society of Europe has been postponed from 1936 to around the first of August, 1937.

K. C. CAMPBELL, *Honorable Secretary,*
83, Portland Place,
London W. 1.

THE AMERICAN BOARD OF ORTHODONTIA

A meeting of the American Board of Orthodontia will be held in St. Louis, Mo., April 20. Those orthodontists who desire to qualify for a certificate from the board should secure the necessary application from the secretary. The application must be returned to the secretary, together with any other required credentials, at least sixty days prior to the date of examination. Applications filed at the time of the board meeting will have preliminary consideration, so that the applicant may be advised of the work required for his subsequent examination. Attention is called to the following resolutions adopted by the board: Any person desiring to make application to the

board for a certificate shall have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the board and based upon the following conditions: 1. He must be an instructor in orthodontia in a school satisfactory to the board. 2. He must be an associate in the office of an orthodontist whose standing is satisfactory to the board. 3. It is to be definitely understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

CHARLES R. BAKER,
636 Church St.,
Evanston, Ill.

F. D. I.

Propositions and Resolutions: Every resolution affecting a question of a practical or administrative character adopted with the consent of the President of the Section must be transmitted to the General Administrative Secretary, who will then submit it to the Bureau of the International Congress as well as to the members of the Executive Council of the International Dental Federation appointed before the beginning of the ninth International Dental Congress. The resolutions accepted will be submitted for approval to the Congress at the time of the general closing Assembly.

Administrations: All funds received by the Organization Committee for the Congress shall be lodged in a bank or banks approved by the said committee. The funds shall be controlled by a finance commission appointed by the Organization Committee. The treasurer shall draw on the bank account to make payments authorized by the Finance Commission. The Finance Commission only has authority to bind the ninth International Dental Congress in respect of any contract, treaty or orders involving expenditure in the name of the Congress. In the absence of the Treasurer, the Assistant Treasurer shall be empowered to carry out all the duties of the Treasurer.

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Send your order and remittance to the Library Bureau, American Dental Association, 212 E. Superior Street, Chicago, Ill.

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